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The Problem of Space.

Part I

Prolegomena to a Theory of Space.

I Historical introduction.

The historical origin of this problem and the conditions which philosophical speculations have given it from age to age have an important bearing upon any solution or theory of it which may be offered. It will have the effect of showing how much is involved in it, inasmuch as the successive deposits of time, common to every form of knowledge and speculation, cannot be wholly eliminated from it. Philosophic thought preserves its continuity while it is constantly absorbing additions which complicate its considerations, and oblige logical analysis as the only condition to any rational comprehension of its problems. Notwithstanding progress and change, and in addition to all the questions of contemporaneous thought, are in-

herit all that the past has contributed in the same connections. Language and associations without any reference to simplicity and consistency contain, and continue in existence, the products of past and recent alike: so as to render greater and more numerous the difficulties which philosophical speculation has to meet and if possible remove. A problem, therefore, and especially a philosophic problem, is not always a simple one. The nature of it, various and, perhaps, divergent lines of intellectual development, the additions of progress and discovery along with the accumulations of the past may make it preeminently complex.

Nowhere has this been more true than in connection with the problem of Space. It took its rise in the complicated question of "common sensibles", which was applied successively or unconsciously by every speculation on these down to the present time. Other important implications grew out of the notion that space was a "common sensible". These

will manifest themselves in the historical survey which we wish to sketch.

Aristotle reports of Democritus that he regarded all sensations a modification of touch.* This position was a corollary of the atomic philosophy whose fundamental assumptions involved a conception favorable to the view that all the senses had a common function, and were affected by the same kind of impressions. The atoms, constituting the basis of the system, could influence each other only by some form of contact. All impressions upon the sensorium were due to emanations from objects and could effect sensations only on actual contact with the organs of sense, either of the object or the emanation image. There must, therefore, be a common relation between the senses in order to receive impressions which can manifest themselves only by contact. Whether the influences which proceeded from the atoms or from objects were corpuscular or undulatory, they were uniform in nature and

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* Arist. De Sensu c. 4, 442. a. 29.

conceptions, so that the ancient conclusion is as drawn [illegible] then was, that sensations which are the effect of this activity would be uniform in kind since the cause was tactual. Whatever the apparent differences in the several sensations, they were still due to the same cause operating in the same way upon each of the senses. And in proportion to the very natural tendency of the system to magnify the importance of contact in the problems, for the two reasons, that touch was taken then, as it is now, to be the most satisfactory criterion of reality, and that the analogies of two other senses, taste and smell, unquestionably related them to touch, — was it reasonable to assume the sense of touch as the comparative standard by which to determine the nature of other senses: especially when the fundamental assumption of the system allowed them only emanations as the cause of sensory action and objects. The fact too that touch was the most general sense, having the largest distribution in the

only, favored the supposition that others were a differentiation of it. Hence the school was predisposed both by its metaphysics and its psychology to the opinion that all the senses were a modification of touch. There is in such a position a firm basis for common sensibles; or at least a scientific confirmation of the general idea in objects of knowledge assumed although uncritically to be common sensibles. The psychological element, however, had much less influence than the metaphysical, because it was not founded upon a scientific analysis of sensations from the subjective side. Its nature and unity were determined from the objective side, and hence made a deduction from atomic metaphysics, or corpuscular emanations. If nothing had occurred to disturb the basal assumptions of this philosophy, a doctrine of common sensibles might have seemed well established to the Greek mind, and to all subsequent philosophy based upon corpuscular as opposed to undulatory metaphysics.

But two distinct events changed the whole aspect of affairs and brought the problem of common sensibles into an importance which it has not lost since that time. They did much also to give the problem that setting in which we are obliged to consider it. These two events were:

1st A change or modification of the prevalent metaphysical notions characteristic of the Atomists.

2nd A psychological analysis of sensation by the scepticism of Protagoras and his contemporaries.

The instigation, however, to both of these departures is found in the philosophy of the Atomists themselves. In the first of these, Democritus and Empedocles let drop the admission that the sensations themselves do not reach the sensorium, but make their impressions upon the intervening medium, which impression is conveyed to the organ of sense. "As the space between the objects and our eyes is filled with air, the images that fly off from things cannot themselves reach our eyes; what does so is the air which

is moved by the images as they stream forth, and receives an impression of them" * Sound sets the air in motion and passes thence to the auditory sense. Hence there is a tendency here to pass from corpuscular images to the idea of motions in the spirit of the Heraclitic philosophy. Besides the Heraclitean school had reduced sensations to be the collision of two motions. This was a less materialistic position than that of the Atomists, and modified all subsequent Greek metaphysics and psychology, although not to any such extent as modern undulatory physics have done for later speculations. Still it was the origin and anticipation of the modern view: but not being fully developed, or scientifically demonstrated its influence extended mostly to set aside the corpuscular metaphysics of the Atomists and acted only as a supplementary force upon later views. Now if the human mind changed its view about the emanation of corpuscular bodies

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* Zeller's Pre-Socratic Philos. Vol II p. 268 (Translation)

from one body to another, its theory of sense-perception introduced ideas that impressions must undergo modifications. The assumption of contact so necessary to explain sensation according to this theory placed touch in the first rank of the senses and made it the standard by which to conceive the functions of others, less general, but connected with a common consciousness.

But in ancient times the Heraclitic doctrine of motion and in modern times the undulatory theory of light heat and sound have changed all this.* Singularly enough the intimate relations between sight and touch along with the other senses, in the older corpuscular theory of sensations stamped itself so thoroughly upon speculations that this relation has been retained, although the standpoint from which to determine it has been completely reversed. Instead of assuming actual images by which to

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* Lotze. Medicinische Psychologie p. 327. 1852.

compare the several senses. The common metaphysical view of the causes and conditions of sensations has induced us to adopt visual and auditory analogies by which to determine the nature of the tactual sense. In the cases of sound, light and heat or hearing, sight and the sense of temperature, we have phenomena to show that these three senses are what we may call undulatory senses; that is, they receive their impressions from some undulating medium, the general assumption being made that the object or transcendental cause of the impression is not in contact with the sensorium. The vibrations of the intervening medium may be in contact with it: but of these we are not immediately conscious, while we have or seem to have some direct and positive knowledge of an object or cause not expressed to us in terms of undulations, and removed from the organ of sense. In reference to these three senses, therefore, the common-sense theory of sensations has to be abandoned, while the general assumption from analogy, the unity of

consciousness. The natural propensity which the love of philosophic unity induces to suppose a common function in all sensations and its objects, and the doctrine of Evolution which regards all phenomena, structures and functions as modifications of a single homogeneous substratum or principle, – all tend to favor the supposition that all the senses are modifications of the same kind of activity. The actual discovery of the nature of three senses would very naturally carry over to the others the principles and theories which had dominated the conceptions of the first. The unknown is thus explained and made intelligible by the known; and such an extension of the hypothesis is reasonable because there can be no presumption against it, until undulations are actually discovered in the case of the tactual senses. Most speculators, therefore, if they do not regard touch as a modification of sight or the tactual sensations as differentiations of the undulatory, a position the very reverse of the Democritic, do nevertheless adopt a view which is equiv-

alent to this: for, they believe, or think and speak of motion or undulations as the condition of all sensations. The whole idealistic school affirms that the external world is but a throbbing mass of ethereal undulations, and hence as a conclusion the inference that the tactual senses, touch, taste, and smell, are at their foundation similar in their conditions to sight hearing and the sense of temperature.

But there is one important difference between the two theories. In the Democritic view touch is assumed as the standard of determination and thus made the genus of which all other senses are the species, modifications of this one sense. But in modern times, when assuming the undulatory senses as determinants of the nature of the tactual senses, we do not mean to indicate that the latter are modifications of the former, and hence that touch is not a differentiated form of sight; but that the fundamental conditions of all the senses are the same; that they are each and all modifications

of the same sensorium, which responds only to certain general forms of force manifested in some mode of motion. The monistic hylozoism [illegible] the same assumptions and conclusions for ancient thought, and determined the metaphysical presuppositions under which Plato had to reconstruct the theory of knowledge.

In both theories there are two points in common and from which the same psychological and metaphysical doctrines may be deduced. They are: first, the identical assumptions regarding the nature of reality; and second, the uniformity in kind of the conditions and the sources of sensations. The latter assumptions in these speculations were [illegible] and revolutionized the problem of knowledge, but were speculative. The consciousness an [illegible] of the unity of sensations which was very favorable to a doctrine of common sensibles. This is evident in the case of the qualities. The senses of apprehension responded to the same kind of stimulus, and hence it would be natural to suppose some common result.

But a theory of common sensibles was not made to depend upon its formulation in enumerations. Indeed there seemed no reason either to suppose or to question such a theory until Plato and Aristotle found it necessary by some means to combat the position of scepticism. Nevertheless, in spite of the tendency in the Heraclitic doctrine of change and motion to forget the uniformity of the constitution of sensations, the mental habit of so regarding them and of seeking philosophic unity in the common functions of sensation lent even the *naive* empiricism of the time the uncritical impression that there were common objects of perception. This position had first to be questioned before any positive doctrine of common sensibles would be advanced or defended. But the general habits of thought and association had unconsciously taught the population [illegible] to think and act upon the supposition that the correlated judgments of sense would be common and mutually corrective. But this position was destined to an early criticism by Protagoras and the Sceptics.

The second instigation to a modification of the theory of knowledge, one which we have adopted without mention, was the doctrine that the sensations whether caused by corpuscular images, or by an undulating medium, did not properly represent the nature of reality. This assumption gave rise to the sceptical method of the Sophists to which we have referred; namely, the psychological analysis of sensations, in which the question was approached subjectively instead of objectively. Intelligible particulars increased in importance, and the problem became largely an introspective one. There were three discoveries of facts which determined the Protagorean doctrine regarding the relativity of knowledge, and which resulted in a direct challenge against every conviction supposing the existence of common sensibles.

They were as follows:

1st The subjective differences between the products of the several senses. The sensorial affections were distinct from each other.

2nd The illusions and contradictions that

appeared in the various judgments of sense, whether as compared between two or more individual persons, or between two distinct senses.

In the first of these cases there could be no agreement as to the real object or its qualities: in the second, the sensibles of the separate senses were distinct from each other and could not be interchangeable or common; that is objects of more than one sense at a time.

3rd The illusions and contradictions that occur within the functions of a single sense uncompared with any other, tending to create distrust in the validity of sense impressions.

The direct influence of the doctrine that sense-perception was illusory, of transient phenomena, and that the functions of each sense were not shared by another was to establish the relativity of sensations and the distinct individual character of each sense. It gave a very great impulse to the idea that each sensation has to be considered alone: especially as the evident illusions between two or more senses

required the abstraction of those qualities, hitherto supposed to be in common. The isolation of the several senses was, therefore, the first step in the dissolution of older views although it did not necessarily involve the relativity of sense-perception even in each individual sense. But the second step of scepticism did this, and it was to maintain that sense-affections were purely subjective transient phenomena with the doctrine of Heraclitus. The two interpretations reduced the activities of sense to individual and isolated states of consciousness without a common or perdurable quality. The common mind had previously assumed or affirmed the necessity of something universal and eternal as opposed to the individual and perishable in order to have a basis for knowledge, theology and political institutions. But scepticism had no concern for any such objects and in order to vindicate its own ends availed itself of every means offered by [illegible] doctrine and the Heraclitic [illegible] of [illegible] phenomena to [illegible] [illegible], therein,

knowledge. Men were shown that their senses were deceptive and it was soon discovered that many qualities supposed to be in the object of perception were inferred and the result of association. Those very qualities were such as had been taken as common to two or more senses. Thus their relativity in a partial sense led directly to the extension of that doctrine, which by the support of the view that sensation was the resultant of two colliding objects or motions, declared sense perceptions to be transient individual phenomena without any universal qualities that the existing ethics demanded. There was then neither a common object of perception, nor any universal permanent principle upon which to base a consistent theory of knowledge, or to satisfy the requirements of morals and religion.

The reconstruction of the theory of knowledge did not begin with a doctrine of common sensibles. The relativity of sense perceptions seemed too well established for this: besides this being a fact,

sensation was too imperfect a source for a reality that must not be contaminated with the contingencies involved in such an origin. Plato therefore resorted to a system of transcendentalism in repetition of Pythagorean theories, refusing to descend into the field of sense for his data, because he admitted with scepticism generally its untrustworthy determinations. Not so with Aristotle. Dissatisfied with the intellectualism of his master, and disposed to vindicate knowledge from the position of sense perception, Aristotle not only retained the idealistic principles which Plato had established, but carried the question into the province of sense perception and added a doctrine of common sensibles as an empirical basis for knowledge which thus afforded a double refutation of scepticism. The quality of universality which Plato had confined to his "eternal ideas", Aristotle expected to discover in a form of sensation which was common to several or all the senses. This he did without denying *in toto* the relativity of sense.

He held that, while the senses had their individual functions qualified to give transient phenomena, they also had the more general function which qualified them to give products common to consciousness at large: that is, common sensibles which were not involved in the 'generation' and "destruction" characteristic of phenomenal appearances. He enumerates them as follows: *Magnitude* or *Extension*, *Figure*, *Motion*, *Rest* and *Number*.* In a second place he adds *Unity* ** to these: and again in a third passage he includes *Roughness*, *Smoothness*, *Acuteness* and *Obtuseness* ***. All these were regarded as common sensibles. As such they were a decided exception to the general doctrine of Protagoras, and of course met that doctrine upon an empirical basis. It was, perhaps, the only way to connect the several senses in the admitted unity

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* Arist. De Anima L. ii c, 2.: L. iii c, 1.: De Sensu c. 1.

** Arist. De Anima, iii 1.

*** Arist. De Sensu c, 4.

of knowledge. The modern conception of the unity of consciousness was not then made the vehicle of that connection or communication between the senses, although this doctrine of common sensibles led to it, and both Plato and Aristotle spoke of a function of mind which was identical with what we regard as consciousness: but it was not employed as frequently or as explicitly as it might have been [illegible] in the conception of common sensibles, although it was evident that both philosophers were led to it by that necessity. It was certainly the corollary of their position.

But the main point which Aristotle wished to establish was the existence of percepts within the functions of sense that were as positive facts contradictory to the assertions of scepticism both as respects the validity of universality and veracity. If scepticism depended upon the validity of the position that there were no common sensibles (κοινὰ αἰσθητά), it was a sufficient refutation of it to show the actual existence of them, while admitting at the same time the exist-

use of ἴδια αἰσθητά or individual sensibles. There is in that position no necessity of an appeal to transcendentalism, although it may serve as a vantage ground for the theory of knowledge independent of sense perception.

But we must not forget what importance the theory of common sensibles had for all subsequent speculation. In early Greek philosophy it was more or less indispensable, as we have seen, to save knowledge from scepticism. The status of the question thus required, as we have intimated, for its validity the supposition of some universal and eternal truths. These Plato found in his "ideas", which he supposed common to all reason, but without vindicating them upon the empirical basis of sensation. Rather did he disparage every hope of finding truth within the range of the senses, whose testimony, in agreement with Protagoras and Heraclitus he uniformly discredited. However the felt want for permanent and universal conceptions produced a method which had only to be modified in order to discover an universal element in sense-intuition. Hence

The doctrine was an effort to restore an empirical basis for the theory of knowledge, by setting up certain qualities, the objects of sense perception, as exempt from the mutabilities of change and decay which characterized the relations and more transient phenomena of sense. But as in modern times we do not look upon any deliverance of sense in the purely 'Heraclitic' sense, the doctrine of common sensibles does not assume the same kind of importance it had in Greece. There it was impossible to solve the problem empirically in any other way. With us the question of common sensibles rather imports a fact, and not something from which we wish to deduce the whole theory of knowledge valuable as it is in contributing to its unity. We do not regard the differential qualities of sensation as necessarily objectless and transient states without significance or existence. Hence we feel no obligations to maintain common sensibles in order to obtain a basis for general knowledge. But nevertheless the distinction which that doctrine introduced was decisive in its end on the questions

upon which apparently depends the whole of modern metaphysics. This distinction was that between the primary and secondary qualities of matter.

With Aristotle common sensibles were not so much as with us a mere psychological fact, but they involved a metaphysical principle as opposed to scepticism, and were designed to distinguish those perceptions which represented what was real and objective to the perceiving subject in distinction from those sensations which were purely phenomenal and subjective. This was of perennial significance both for the theory of knowledge and the theory of things. It is for its influence upon the distinction between primary and secondary qualities and their implications that the Aristotelian doctrine has been so well worth an elaborate notice. It has decided the course which philosophic reflection had to take, and given much of the setting, at least indirectly, to the problems we have to consider. It has been the starting point of numerous theories not contemplated by the originator, although implicated in the doctrine he

advanced. Each implication in it involved others which rendered its development possible.

Aristotle did not employ any such terms as "primary" and "secondary"; but his κοινὰ αἰσθητὰ and ἰδιὰ αἰσθητὰ were expressions for precisely the same distinctions which persisted with some variations in to the qualities included in one or the other, until the time of Kant, whose theory of space and time rendered the distinction unnecessary and nugatory to his philosophy, and it has been dropped since in all systems of Idealism, and retained only in some forms of Scottish Realism. Let us see, therefore, what philosophical problems were developed out of it.

It is not necessary to trace the full history of the terms embodying the distinction in view. It is enough to know that they imply the same κοινὰ αἰσθητὰ and ἰδιὰ αἰσθητα, or the common and special sensibles of Aristotle. The distinction therefore between primary and secondary qualities was that between objective and subjective phenomena. The former were

regarded as representative of the real and universal objects of knowledge, characterizing their nature as opposed to their mode of affecting the mind. They were the absolute elements of cognition. The latter or secondary qualities were relative and subjective; that is representing merely states of the sensorium or of the subject; such as color, temperature, sound, taste, odor &c: and although they were admitted to have a corresponding and correlative cause objectively, the sensorial affection was very different in its nature from its cause. They were separated from each other by all the difference between a mode of motion and the notions of color, heat-cold, sound &c. between which no resemblances can be discovered. But the primary qualities, such as space, time cause, substance &c. were immediately and objectively cognized. The first great questions which this distinction gave rise to were the doctrines of Realism and Idealism. The former doctrine was supported upon the notions of primary and the latter, upon the notions of secondary qualities. Both theories vied with each other in the [illegible], not

only as one or the other of the principles involved in the distinction between primary and secondary qualities tended to assume the predominance. The priority of the real or the ideal in perception varied with speculation regarding both the nature and extent of the two kinds of qualities recognized in sense perceptions. Gradually the distinction came to be felt as violating the unity of mental processes connected with sensations, so that the natural tendency was to make phenomena either all subjective or all objective. With Descartes even the only primary qualities which have an influence in determining his metaphysical doctrines are extension and motion. There was a disposition in Locke to make some of them ideal, as in the case of substance. Berkeley denied the distinction entirely. Besides, the ineradicable position of the Cartesian philosophy that self-consciousness, which was a purely subjective factor in knowledge, was the ultimate criterion of all knowledge, and the position that sensations were but modes of consciousness decided the direction of speculation in favor

of subjective methods. The outcome of it was the system of Kant, with the general protest of English thought in favor of realism. But the whole discussion between primary and secondary qualities did not subside until it had produced and defined the doctrines of realism and idealism.

Another line of development involved a second set of questions. Locke's problem was the origin of our ideas, and he traced all our knowledge to experience. He nevertheless assumed the distinction between primary and secondary qualities. Among the former were space, motion, rest and number. To omit the consideration of the latter as irrelevant, space he also regarded as a common sensible, common to sight and touch, and at the same time as a primary quality. He classed the idea of space among his "simple ideas" by which he meant that it was an ultimate and unanalyzable datum of experience or sensation. Thus it was a natural, not an acquired perception. In addition it was regarded as a transferred or associated element of perception, and

was an acquired or not of that sense. This method of indicating where it was native and where acquired introduced a distinction which Berkeley made further use of in connection with his doctrine of space. Berkeley undertook to show that space was not the natural object of sight, but of touch: his argument however, applied more particularly to the third dimension. His position raised the distinct and disputed question whether space was a native or acquired perception of vision, and the manner in which he idealized it was a step toward the doctrine of Kant. Berkeley's position, however was still consistent with the notion of common sensibles as the distinction between original and acquired perceptions, or between native and transferred relations enabled philosophy still to retain space as a common sensible although in a modified sense. But notwithstanding this the doctrine that the idea of space was an acquired one to vision was, at least on one side or in one direction an extension of the [illegible] theory of experience. One has only to suppose it an acquir-

ed percept of touch to make it a purely empirical datum of intelligence, along with all other products so regarded. Berkeley's method was to show the inference and mistaken judgments regarding space in the sense of vision, and on this means to prove its empirical nature in that province. This exhibits to us, therefore, at what point the important question was raised whether the idea of space was apriori or empirical. The general spirit of Locke's speculations favored the latter, and it needed only the argumentation of Berkeley to extend it, although in disputing it as the natural object of sight he had to distinguish between common sensibles as original and as acquired products of sense. Hence again the original distinction of Aristotle between κοινὰ αἰσθητὰ and ἴδια αἰσθητὰ further divided itself into the two questions whether the κοινὰ αἰσθητὰ were native or adventitious. The outcome of the original question of common sensibles is, therefore, the controversy between nativism and empiricism. A brief account which will summarize the whole historical development of the problem will

are formulated in the following paragraphs, and then viewed in their several aspects.

1st. The original question was merely the psychological question of common sensibles, supposed to present a permanent element in knowledge as opposed to the accidental and contradictory data of subjective sensation. Hence in Greek speculation in the time of Plato and Aristotle common sensibles meant *something persistent in consciousness.*

2nd. The second stage of development in the problem was the distinction between the *real* and the *ideal* sensibles, a distinction implied and embodied in that of κοινὰ αἰσθητὰ and ἴδια αἰσθητά, but was not made the acknowledged criterion between Realism and Idealism until later ages. The question of mere persistency in consciousness was abandoned and the problem of modern philosophy was *whether sensibles were subjective or objective elements of knowledge or consciousness.*

3rd The third stage of development assumed the position of investigating the *genesis* as opposed to the *nature* of sensibles. Realism and idealism were raised upon questions regarding the nature or object of perceptions; but the spirit of Lockes philosophy, concerned about the origin of knowledge, changed the direction of speculation into the question of the genesis of sensibles, both common and proper. Hence, as in the case of Space, the modern problem regards the question *whether it is an original or an acquired notion*. It is the problem of *nativism* and of *empiricism*.

The three stages thus summarized can be characterized in still another form, although each aspect of the question may have been involved in every stage of its development. They are:

1st The *psychological* fact of sensibles common and proper.

2nd The *metaphysical* implications of sensibles common and proper.

3rd The *historical* genesis of sensibles common and proper.

The following Greek outline represents every stage of the discussion both historically and logically, beginning with the earliest conceptions of knowledge which was ordinarily limited to sensibles. This was necessarily and rapidly modified by the interpretations of Plato and [illegible]. But the data of knowledge, and the stages of development in its theories were as follows:

1st αἰσθητά
- Consciousness was then all [illegible] and objective
- Scepticism was then all [illegible] consciousness & subjective

In this knowledge was limited to αἰσθητα or sensibles

2nd αἰσθητά
- κοινὰ αἰσθητὰ = Persistent and objective. Real
- ἴδια αἰσθητὰ = Phenomenal and subjective. [illegible] Ideal

3rd αἰσθητά
- κοινὰ αἰσθητὰ
- ἴδια αἰσθητὰ
  - Nature
    - Subjective = Idealism
    - Objective = Realism
  - Genesis
    - Original = Nativism
    - Acquired = Empiricism.

In the third we have the distinction between the nature and the origin of sensibles added to the Greek conceptions.

Thus we discover how a single problem may develop into several of equal importance and difficulty, yet entirely distinct from each other: although in actual historical discussions they were often confounded with each other. This is evident when we compare existing discussions about the idea of space with those of Kantian Idealism. There is an utter failure to observe the difference between the logical character of our idea of space, and its historical origin. This distinction really divides two different modes of thought and two separate problems. Idealism and Realism are founded upon the nature of mental perceptions, and not necessarily their historical origin, which is merely a reference to the invariable and causal order in time assumed by certain perceptions. Hence the question of all sensibles, common or proper, divides into that of their nature and their genesis: and each problem must be investigated separably.

It was the philosophy of Kant which gave the greatest impulse to the problem of space. Before

The ideality of space and time, along with the categories of cause, substance, number &c. which had commonly been regarded as common variables and immanent qualities of objects, he founded a system of transcendentalism which was aimed directly in the face of every existing system of empiricism. At the same time he denominated space and time, along with the categories, as apriori in opposition to the idea that they were derived from experience, or were aposteriori. These two aspects of this theory the ideal and the apriori nature of space and time divided speculation immediately, and subsequent philosophy reveals several motives and various attitudes upon the problem.

First, there was the motive to defend the Kantian conception of space and the originality of our idea of it, in order to maintain the theory of knowledge on the place which intuitive theories had assigned it.

Second, there was the motive to defend its ideal nature in order to secure an adequate basis for application of mathematics. Third there was the mo-

time to controvert the subjective conception of space in order to avoid the scepticism it implied regarding all well established convictions, and to escape the subtleties of transcendentalism so unintelligible to ordinary minds. Fourth, there was the motive to oppose Kant's view of the apriori nature of the idea of space and time in order to defend successfully a system of empiricism, because as long as some apriori principles and ideas were admitted, empiricism occupied a secondary and subordinate position. Until Kant proclaimed the subjectivity of our idea of space, there was, perhaps, but one motive to controversy on the subject, and that was whether it was a common sensible or not. But the strength of Kant's position regarding both its ideal nature and its apriori origin was a challenge to empiricism, because its formal relation to all objective knowledge completely refuted that theory and its claims for prior consideration in speculative questions, unless it could change its ground and concede an idea which Locke and his school had admitted to be

empirical. Primarily the problem concerned the conditions of sensory qualities. But Hume's analysis of substance and cause, and Kant's doctrine removed these to the sphere of intellectualism, and left space and time as empirical and apriori data to decide the question between apriorism and empiricism. There was left then no alternative but to discuss the apriori nature and origin of our ideas of space and time.

The controversy, however, has been one of very great indiscriminations. The proper analysis has not seen distinctions and hence questions of common sense, realism, idealism, apriorism, empiricism have been confused with each other, as if the decision of one of them set at rest all the difficulties of every other problem. But the history of thought as we have given it showing the ramifications of speculation upon an apparently simple problem shows that it can be answered only after the most careful analysis of all its implications. It is no longer a simple problem.

Prolegomena to a Theory of Space

II Analysis of the Problem.

The historical development of thought regarding the question of space, or [illegible] sensibles in general, offers a partial analysis of the problem as it appears in speculations since the time of Kant; but it does not present it in any form which will enable us to see the range of the almost inexhaustible materials and controversies that Kantianism has sprung upon science and philosophy. We have merely examined the historical steps by which the mind passed from one phase of the subject to another, and how the idea of space has become complicated with various distinct questions.

The analysis of the problem of space, therefore, which we wish to give will be aimed to show the distinct questions involved in modern discussions of it, and thus indicate why it is so complicated a problem. The speculations of Müller, Herbart and the Herbartians,

Helmholtz, Hering, Wundt, and others show the greatest confusion as to the point at issue, while the terms employed in discussing the question are not comprehensive of the various and totally distinct facts, experiments and reasoning used in the discussions. It is the universally accepted assumption that the question is about the a priori or the empirical nature of space or our knowledge of it. But the nomenclature indicates that these conceptions are made to hold to other and separate questions, as well as the complicated mass of unanalyzed facts and theories which they are made to cover, renders it very doubtful whether the alternative of speculations lies between these two distinct methods of solving the question of space. The general impression from scientific discussions is that we must adopt one or the other of these theories of space, when, perhaps, analysis of all that is involved in the questions may show a larger possible attitudes in the controversy. Every term in the dispute has so many different implications that it is unsafe to employ it in any investigation dis-

are properly qualified. Like all other philosophical terms they have carried along with their existence all the accumulated conceptions connected with their history, and hence are constantly liable to misinterpretation by one or the other parties to a dispute. To give an illustration of this fact and to prove what analysis is required, we can take the case of the conceptions which have determined the use of the terms empirical and apriori. In the discussions of the present day concerning the idea of space the implications of these two terms have completely exchanged places with each other as compared with the time of Plato, while certain other associations have remained unchanged.

The empirical scepticism of Protagoras was designed to show the merely phenomenal nature of all sense perceptions, as we have seen; that is, they were individual mental states existing only for the time they were experienced and having no resemblance to their causes or objects. Empiricism here almost if not entirely identical with Idealism which analyzes such conceptions as

impressions, while assigning them only a passing existence. The apriori philosophy of Plato was set up as a defence of reality, of some permanent qualities that were superior to the transient phenomena of sense. The apriori position was therefore advanced directly in the interests of reality, of certitude and uniformity in knowledge. But since Kant empiricism is the position assumed to oppose idealism and to defend the objective reality of our knowledge, and apriori is supposed in empiricism to be synonymous with transcendentalism. The sensationalist theory was the nominalism because he is still discussed in the era of Plato that makes them all opinions relative and uncertain, we must put a check to the harmful consequences of relativity as taught by Protagoras. While this change in the two fundamental conceptions of the schools was taking place, the complete reversal of their relations to realism and idealism, the intellectual moral and religious sensibilities of the two positions have remained the same: the one favoring, the other discouraging them. The

reason for the change of this metaphysical modifications is the fact that since Plato we have changed our notions regarding the validity and the nature of sense-conditions: but we have not been able to [illegible] of errors in use of the terms or conditions embodied in the terms "empirical" and "apriori" the disagreeable associations which are suggested in other connections. A fact like this will show what a careful analysis is required before we know what our problem really is. We shall have as a consequence three separate systems of analysis.

1st Analysis of the several speculative attitudes and theories regarding Space.

2nd Analysis of the notion of Space in reference to the various theories regarding it.

3rd Analysis of the implications and associations historically connected with the conceptions embodied in the terms "apriori" and "empirical" or "experience"

I. Analysis of the speculative theories in reference to space and the idea of space

The historical introduction gives us a hint of this analysis. We there found three distinct problems in history associated with the question of space and our knowledge of it. They were:

(a) The problem of common sensibles.

(b) The problem of the nature of our idea of space.

(c) The problem of the genesis of that idea.

We are now to undertake a more complete analysis of the motives involved in the historical development of discussion upon this question. In order to see the complicated elements involved in these and later discussions I think we shall assume in this first question, that the idea of space and the conceptions of nativism and empiricism need no definition, and shall show how many aspects there are in the problem upon any single supposed assumptions. We must distinguish the several individual problems that have been confused with each other.

First: we must insist upon distinguishing and separating apart from each other theories regarding space, and theories regarding the knowledge of space. The first class of theories have to do with the question whether space is independent of the elements or a mode of it. Next the psychological questions arise as in connection with sight and touch their relations &c. Arguments and reasoning regarding it however they may be related to the psychological problems, are quite distinct in their nature from such as we have to consider in the *idea* of space.

Second, in accordance with the historical development which separated the questions regarding 'primary' and 'secondary' qualities from that regarding the genesis of our space idea, we have to further distinguish the *nature* of our knowledge of space, from the *genesis* of that knowledge. The one is a logical, and the other is a historical question. Theories may decide upon these questions without having any necessary connection with other members of the analysis, as well as without prejudice to following similar methods.

Theories in Connection with the Problem of Space.

- Metaphysical Theories (of the Nature of Space)
    - Ontological = Space Absolute, independent Existence.
    - Phenomenological = Space Relative & mode of the Absolute.
- Epistemological Theories (Of the Idea of Space)
    - Theories of the Nature of this Idea.
        - Ontological = Realistic. Objective
        - Psychological = Idealistic Subjective
    - Theories of the Origin of this Idea
        - Nativistic or A priori
            - Psychological.
            - Physiological.
        - Genetic or Empirical
            - Psychological
            - Physiological

in view of the distinction between the nature and the genesis of our notion of space we shall be content with references.* Nevertheless historical discussions have constantly confused these. Since Kant empiricism has made this discussion of the problem the special object of its hostility, and many speculations presume that the demonstration of its empirical nature is a refutation of his idealism; on the other hand apriorism relies upon the authority of Kant's philosophy as ground for support of the originality of our space conceptions. But it is possible that the nature and relations of space and of our idea of it may remain the same whatever the origin of our knowledge concerning it. This being the case we must separate present scientific discussions of the question from the general position of the Kantian philosophy.

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* Lotze. Medicinische Psychologie. p. 41. 1852.; do. Microcosmus Vol. III pp. 188. 200. 475. 3rd edition. 1880.; do. Metaphysik. pp. [illegible] 194. Bowne. Studies in Metaphysics p. 3. Ribot. German Psychology of To-day p. 33 (translation

There are two distinct and independent elements in Kant's conception of space, even if we suppose the terms confined to the nature of it and as having no reference to its origin. But it also conforms to the distinction drawn between logical and historical questions. The two elements are.

1st Space as a subjective form of external perceptions.*

2nd Space as an apriori element of knowledge.**

By the first of these Kant means that space is an idea; it is a modification of consciousness, a mental condition of all perceptions in relation to the external world. Herbert Spencer*** in this connection misrepresents this view by supposing it to mean that we can have no states of consciousness without the notion of space in connection with them. But Kant means no such thing; he carefully guarded [illegible] against any such notion by making it the

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* Kant. Kritik d. r. Vernunft. p. 66. Hartenstein. 1853.

** Kant. " " " " p 63 " "

*** Herbert Spencer, Psychology Vol II pp. [illegible]

form of _external_ perceptions, allowing for _internal_ states which did not involve it. This express statement that it is the condition of _external_ perceptions that distinguishes it from perceptions not localized, or referred to externality: but he seems perhaps wrong to consider it ideal whenever it occurred in the experience of the subject, even if alleged innate nativity. In this element his chief object was to indicate its ideal nature, and it could be this whatever its genesis.*

By the second element he meant to assert that it was "given" (gegeben) in knowledge, not derived as empiricism affirmed. Nor did he wish to assert its temporal priority to experience, but that it was independent of experience for its derivation. He granted it an origin; but it was an apriori origin, an immediate presentation of consciousness. It was not a mediated and developed conception, or the result of abstractions from sense perceptions as is the case with ma

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* Ribot: German Psychology of To-Day, p. 33. Translation.

general conceptions from experience. But as an apriori element of knowledge it was "given" or immediately known, whether it be regarded as subjective or objective. This distinction will have no great importance for determining the relations of empiricism to rational theories in general. It must be granted, however, as well as remembered, that apriori does not always and in all relations have this single meaning in Kant. It is also used to denote two other conceptions historically associated with it. They are:

(a) The necessity, self-evidence or certitude of certain elements of consciousness.

(b) The condition or form in which all experience prior to its first origin must be conceived.

These may be coincident and coextensive with the first, but they are used with reference to states of consciousness, or truths which are deductively produced. This, of course, anticipates experience. But with reference to the genesis of space ideas "apriori" means immediately given in consciousness. The use and sig-

portance of the other two meanings will be noticed in another connection.

That the subjective and the apriori nature of our notion of space may distinguished is evident from the ideal theory of the secondary qualities of matter, namely, color, sound odor &c. In Kant's time these were considered uniformly both as empirical and subjective. They were really [illegible] elements of knowledge and at the same time they were conceived merely as affections of the consciousness, affections which did not adequately represent the nature of the objective cause. They were, therefore, mere modifications of consciousness, and hence subjective or ideal. They were not required to be apriori in order to be this: they could be ideal with an empirical genesis as well as any other. Now in as much as Kant's elevation of the "primary" qualities to the class of subjective states of consciousness, and along with them the idea of space, must be subject them without excluding their empirical origin any more than the "secondary" qualities, we

are no reasons why empiricism as such should not object to, oppose the subjective conception of space. Indeed in our conception of the term empiricism we can discover in the sequel that the logical consequences of its position and reasoning inevitably lead to that very result. But aside from this at present its natural object of hostility is the apriori conception of space, and not its ideality. In another connection we shall be able to indicate a relation between these two positions: at present, however, and without waste of time to a discussion again we shall assume them in their generally accepted import which conceives them as opposed. Hence accordingly it is the apriori element of Kant's view that should be the natural object of opposition from empiricism, and not its subjective features. The empirical origin of sensation qualities and their subjective nature at the same time is necessary of that matter, of course; empiricism and idealism coincide and coexist. That the empirical origin and the subjective nature of the idea of space were exclusive of each other were

due entirely to association. Kant's theory was thought of as a whole and as it contained both the apriori and subjective elements, criticisms of the theory at large told against both elements alike. Empiricism and apriorism were necessarily used as hypotheses opposed to each other, and the former in disputing the latter carried its opposition to associations even to the subjective nature of space because it was found connected in thought and language with discussions about its apriori character. But they are not correlative elements of the Kantian theory unless we choose to impose a meaning upon the term "apriori" borrowed from the subjective principles of the Cartesian philosophy. This is, however entirely foreign to the original purpose of Kant: although there are traces of its use. But he is very clear in the critical emergencies of his views and uses "apriori" in its [illegible] accepted meaning to import a necessary as opposed to a contingent element of knowledge, while subjective may be taken to comprehend both of them without distinction, as has been shown.

This argumentation indicates the two important limitations which ought to be set upon the premises and conclusions of sensationalism. They are as follows:

(a) It does not necessarily, as a theory of the notion of space, exclude its subjectivity. This is a supplementary and independent issue.

(b) The validity of its position against apriorism does not logically implicate it in hostility to the subjectivity of the idea of space, because the two are distinct issues.

We are thus able to see the confusion of thought which may arise in this question. As long as two or more relevant or irrelevant implications are involved in any given theory, the theory is not a simple one, but is composed of as many elements as it has relations and implications. If these elements are entirely distinct from each other a theory thus may [illegible] more than its legitimate function if it assumes that its success in one direction is equally valid in all others as a result of that fact. Thus looking at the subject historically and logically we shall discover a number of complications which demand a

[illegible] upon a solution of the problem of [illegible] [illegible]. We observe logically that the a priori and the subjective nature of space are distinct; that idealism, or the subjective view of space is not necessarily either include or excluded by empiricism; and that apriorism and empiricism are mutually exclusive. Also historically that the a priori conception and the subjective notion of space have been associated and perhaps considered in some ways; that empiricism and idealism have sometimes been opposed to each other and sometimes held in common, — we see very readily why the implications of speculation have not been easily evolved. Let us notice the possible combinations of views that may occur with reference to these three speculative theories, apriorism, empiricism and idealism. The assumption throughout is that apriorism and empiricism are mutually exclusive, while these are each [illegible] related to idealism in their historical environment. We shall name these theories in their order A. B. and C.

If A and C are independent of each other, B may oppose A and favor C, or oppose both A and C. If A and C are

involved is so necessarily connected with each modifying the other B must oppose both without an alternative. If B and C are regarded as consistent A will not only oppose B but will so as may be logically required to oppose C. If B and C are independent of each other A may oppose B, or both B and C. Precisely the same number of complications are possible if we substitute Realism, which we shall call D. for Idealism, called C. But it also increases the possible attitudes still more if the antagonism between Realism and Idealism be taken into account at the same time. We shall thus have four terms in consideration A. B. C. and D. By supposition A and B are necessarily contradictory to each other; also C and D. But A and C in some cases have been held together and in others A and D. In still other cases B and C have been held together, and in a fourth class of cases B and D have been held together.

If A implies D, then B is committed by necessity of its opposition to A to oppose D also, and thus to imply C by reason of its opposition to D. On the other

hand, if A implies C then B must oppose C, for its opposition to A opposes C since not implying C which is opposed to C. Again if B implies D A has no alternative but to favor C as its opposition to B and its contradiction is already committed by hypothesis: and so on if B implies C.

But still again, if A does not imply D and they are independent of each other B may oppose A and favor D, not thus be forced by the opposition to C or D to oppose C also. But if at the same time that A does not imply D, it implies C then B cannot imply D because its opposition to A requires it also to oppose C, so that it must favor D as [illegible] it cannot imply it. If A implies neither C nor D B may oppose C and thus favor D, or oppose D and thus favor C while it is opposed to A: or it may neither favor nor oppose either C or D. The same number of combinations can be repeated if we start with B instead of A, in which we would define the attitudes to be assumed by A.

Now leaving out the question of implications of which the attitude of each theory is predetermined and taking up consistency between certain theories we still further complicate their relations by showing points where contradictory theories agree, or exhibit a common relation to other theories. If A is consistent with D, that is neither implies it nor excludes it, but can be held at the same time with it, and also is consistent with C, then B may favor D, or it may be indifferent to it, while opposing A. Thus A and B may both or either of them favor D, while opposing each other, and both oppose C: and so on with other combinations.

All this simply means that the attitude of any one theory with a determined attitude toward others of what it opposes are the implications in its theory: these and very often so its mere associations without stopping to consider whether the implications are logical or associative. Thus to make the case more concrete, if empiricism opposes rationalism the reaso-

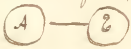
ary consequence of empiricism. It would contend equally against the former as well as the latter; if realism and apriorism have been constantly associated and used to confirm each other, empiricism would find it an easier task to oppose both than to oppose one and favor the other. If apriorism favors idealism empiricism would naturally assume the cause of realism in order to throw apriorism upon the opposition, that it may double its force as an antagonist.

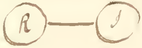
If again there is any sense in which apriorism or empiricism may be consistent; and realism and idealism reconciled, while in other senses they contradict the controversy is manyfold more complicated. But suffice it to say that the real or supposed implications of any theory often have much to do with the facts, arguments and attitude chosen by an opposing theory. This can be avoided only by definition and analysis which will show the exact relations of every conception to every other element in the problem.

We can summarize the analysis we have

given by means of a system of symbolic circles shown to represent the several theories apriorism empiricism realism and idealism each represented by the corresponding initial letters A. E. R and I. A straight line connecting any two will show that they are conceived as contradictory to each other. The absence of a line of connection will indicate that the two are conceived as not necessarily related. and a curved line connecting them will indicate that they are conceived as mutually involved in the same presuppositions

1st Genesis of Space.   2nd The Nature of Space.





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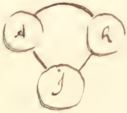

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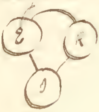

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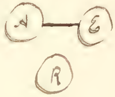

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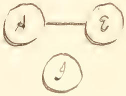

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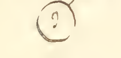

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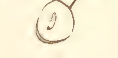

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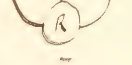

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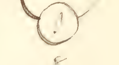

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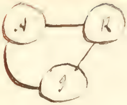

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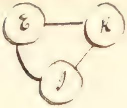

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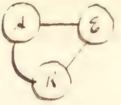

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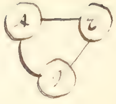

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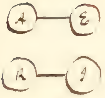

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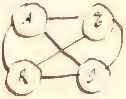

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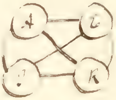

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The fact that such confusing complications have actually occurred can be confirmed by reference to the controversies supposed to have been raised by Kant. Certain scientifically disposed minds, like J. S. Mill, Helmholtz and Wundt, inclined on the one hand to the methods of experimental science, which were presumably empirical, and on the other opposed to the transcendentalism made to follow from the Kantian subjectivity of space, felt the necessity of supplanting it by a view that would accord more easily with the natural convictions of common sense. Hence if its subjective nature was to be disputed, it must be shown not to be the form of perception, the con-

dition of all states with reference to the external world. As a condition or form of perception it must be either antecedent to, or necessarily concomitant and inherent in the act of perception. Thus the only alternative that it seems apparently at least was to maintain that the sensations of which space was said to be the form could take place independently and antecedently to the notion of space. From this all who have been so opposed to the view of Kant have inferred that its formal relation to perception was disproved and hence its subjectivity nullified. But it is entirely forgotten in this argumentation that the antecedence to or concomitancy with perception does not in the least imply that the idea of space is an ideal condition of that perception: hence the disproof of assertions whose chief characteristics and functions is to maintain that the notion of space is original, not acquired by experience, does not affect necessarily the question of its subjectivity; even if it does negate the supposition of its formal relation to experience.

Besides certain forms of nativism have been so decided as empiricisms in their opposition to the subjectivity of the space idea, holding in common with empiricism the necessity of accepting common sense in favor of realism. Thus, apriorism, or the doctrine that the idea of space is not a product of experience, necessarily involves idealism as its consequence. The contradiction of apriorism or empiricism would involve the denial of realism and the implication of idealism, the very position that [illegible] the [illegible] of empiricism. And space speculation may divide upon the nature of the formal relation of the idea of space to experience or perception, one side holding that it is subjective and mental and the other that it is objective and real, with such a complement or accompaniment of mental elements as must be found in all knowledge of reality. No attempt can be satisfactory which would connect the apriori with the subjective notion of space by means of the doctrine regarding its formal relation to knowledge; because in too many other cases empirical genesis is not only consistent with, but implies subjective characteristics.

The only possible way to make the controversy a clear one is for both apriorism and empiricism to be separated, as the logic of the case requires, from the questions of realism and idealism alike. The distinction which we have given regarding speculation as to the _nature_ of our knowledge in distinction from its _genesis_ ought to set this matter at rest. Hence as a conclusion, not to confirm Kantian philosophy, but to simplify our problem empiricism must be limited to the mere question of the origin of the idea of space if it is to be a simple question. There is absolutely no need that it should either connect and confuse the apriori element of Kant's view with the subjective, or repudiate his idealistic tendencies in order to vindicate its own view of the problem. Kant's position can be entirely ignored in this respect by empirical science. Whether the apriori element can be ignored or reconciled with the empirical or not is another question, to be considered again. For the proper limitation of the question at present it is necessary only to ex-

clude it from the necessary consideration of either realism or idealism. Unless it is so, the symbolic representation of its possible relations will indicate far more than any rational discussion can possibly accomplish. The dispute is whether the idea of space is original or acquired, whether it is native or due to experience: any other implications only serve to confuse the conceptions made to comprehend them. Two great questions are thus excluded from our consideration, although historically associated with it. They are:

1st The question of common sensibles

2nd The question of the nature of the space relations.

Both may have intimate relations to the problem; but neither the denial nor the affirmations of the first, nor the settlement of the second of these questions decides one way or the other the problem concerning the origin of the notion of space. Even if it be a proper assumption the questions of its origin may still divide modern thought on the ground that the belief and conception of the validity of sense-perception has changed since the time of Plato. The

single visual motion [illegible] or muscular elements since that one of the nativism or empiricism of visual seeing, Müller, Volkmann, Helmholtz &c should be merely whether our knowledge of space is original or derived, whatever its nature. The last is rather a metaphysical problem of analysis and not of the genesis of ideas.

But if this limitation and analysis of the problem were all that is necessary it would be a comparatively simple question: one might choose one side or the other without qualification. But the notion of space is so complex, the same minds have been so divided on the question according as one element or the other was considered that still further analysis is necessary. It puts the same person an empiricist in one respect and a nativist or apriorist in another, so that the very elements have to be kept distinct from each other and discussed alone. As long as a man may be an empiricist in one relation and a nativist in another in respect to the same problem, general empiricism, or nativism may be impossible. Hence further analysis is necessary.

2nd Analysis of the Notion of Space in reference to the general Theories of it.

Is space a common sensible? This question cannot be answered without analysis, because examination shows that it involves two or more quite distinct problems. If each conception which constitutes it were definite and unmistakeable in its meaning, it might be answered by a simple presentation of facts, or an appeal to consciousness. But as the doctrine of common sensibles no more signifies what it might have signified to Plato, and cannot imply necessarily more than a psychological fact to us, except on historical associations, it can have no decisive speculative importance except in connection with other problems quite independent of it really although implicated in it historically; namely empiricism and nativism. Suppose it granted that it is a common sensible, the question arises whether it is as such original or acquired, and in nearly all disputes as to this

point there is the virtual doubt raised whether it is a common sensible or not, without discussing the Kantian conception of it. For the denial of native common sensibles makes this question necessary, which is tantamount to the denial of common sensibles in any sense, for those [illegible]. This suggests the further consideration involved in space as an abstract notion and as an individual notion or percept. Is it a common sensible as a product of one kind; or is it a common sensible as the result of abstraction from the several senses? And thus again nativism and apriorism may be complicated with each of these.

Assuming the expression "common sensible" to import merely a judgment of extension, in the case of space without reference either to whether it is concrete or abstract, or whether it is native or empirical, there would perhaps appear no objection to an affirmative answer to the question. We should admit under the limitations thus imposed, that space is a common sensible.

We have only to refer to the fact which is undisputed in reference to three senses, touch, sight and hearing, and the less supported cases of taste and the sense of temperature, — that judgments of extension or distance actually occur, at least in all normal and mature experience. But the problem is not of so easy solution. Evidence could be drawn from consciousness and from the number of experiments in existence on the case which would effectually show how spacial judgments and perceptions were actually connected with more than one sense. But from its origin to the present day the doctrine of common sensibles was not only concerning the mere fact of such judgments and their common connection with several senses, but it also involved or implied the more important problem whether they were the native or acquired function of each, or of several senses; or whether native to one and transferred to another. The fact that spacial relations could be inferred altered the problem: one part of it could be answered in the affirmative and another

in the negative. The proof that spacial judgments take place in several or all senses is no proof that space perception is a natural function in all cases. Besides its proof as a natural or as an acquired function in any or in all senses does not decide whether it is so as an individual or a general conception. We have therefore the following several distinct problems.

1st Is space a common sensible?

2nd If so is it common as an { Individual Percept? or General Concept?

3rd If it is common as a concrete individual notion is it as such { Native or Apriori or Acquired or Empirical.

4th If it is common as an abstract general notion is it as such { Native or Empirical.

5th If it is not a common sensible is it in any case a special sensible { Native. or Empirical.

Whatever the implications in any one of these questions, they may all be discussed separately and in distinct arguments: although in some cases certain facts and phenomena may have two or more relations and thus involve separate problems. In other cases facts may have but one significance. In the *first* problem it is mainly a question of psychological facts. In the *second* it is a question regarding the *nature* of psychological products. In the *third*, *fourth* and *fifth* it is a question regarding the *genesis* of these psychological products, and in three distinct forms.

In the second a man may be a nativist in reference to one conception of space, and an empiricist in reference to the other without bringing the two theories into contradiction. In the third and fourth if a man hold that there is both a concrete and an abstract notion of space, as is possible, he may be a nativist in reference to one and an empiricist in reference to the other without contradicting himself. So that a contradiction is possible only when opin-

can decide more than the conditions of space.

It has been customary on the part of both theories of space to prove one aspect of their problem and then generalize its conclusions in all these without reflecting that such an analysis of its elements as we have given makes this impossible, and that it is incumbent upon them to pursue each individual question by itself. Every distinct nature of it requires its own method of investigation and proof. So that either theory has a very broad or a very narrow field in which to vindicate its legitimate applications. Thus nativism as a general theory can not without qualifying its conception of space must show its validity in every possible application of the term space, or it has not disproved the possibility of empiricism, and so with empiricism against nativism. The two views must either be mutually exclusive, or both relatively legitimate within proper limits. In the first case it is a choice between logically contradictory positions and only one theory can be supposed to exist in one or all senses of the problem: in the sec-

and case, it is a question regarding the merits of individual elements of the problem, and each theory may have a legitimate sphere assigned to its function, because special features of the case are distinct from others. This is grounded on the assumption that neither theory in conception is logically exclusive in those same considerations where the two provinces do not coincide: that is, neither view in reference to any given fact can prevent apriori objections in the other in all cases or where the question at issue in the first case is independent of that in a distinct and separate fact. This is made evident by a reference to Helmholtz*, who although a pronounced empiricist in regard to space is just as pronounced an apriorist in regard to causality. Objections therefor to nativism in reference to space cannot be upon the logical and apriori ground that it can be valid in no case; but only upon the merits of the special

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* Die Thatsachen in der Wahrnehmung. p. [illegible]

[illegible] [illegible] [illegible] [illegible] the idea of space. The same analysis can be carried into the various elements and individual characteristics of space, as we see is actually done by some who are nativists in reference to one aspect of the problem and empiricists in another. For instance Berkeley* was a nativist regarding tactual space but an empiricist in the question of visual space. Wundt** defends nativism in some of its aspects but is a warm empiricist in others. Hering*** who is generally spoken of as an uncompromising 'nativist', while holding that a germ of the idea of space is native to vision, its developed form is empirical to that sense. Volkmann**** takes a similar position for sight holding that there is a native perception of indefinite space, but that its size, direction and the relative position of objects are empirical and due to experience.

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* Fraser's Selections from Berkeley pp. 170. 177. 218.

** Wundt's Physiologische Psychologie Vol II pp. 23. 176.

*** Ribot. German Psychology of To-Day p. 129. (translation

**** Wagner's Handwörterbuch. III 1. pp 316. 34

But there are still two directions in which this analysis can be made more exhaustive, showing still greater complications than those just indicated. The two theories have carried their divisions much further than the questions regarding common sensibles and the question whether a common sensible is concrete or abstract. We may limit the problem to the individual senses, and the several dimensions of space: a third direction may be indicated in the question between definite and indefinite space.

__First__, we may take the idea of space in reference to individual senses, and may have as many kinds of space perception as there are senses to perceive it; tactual, visual, auditory &c: if we can include the senses of taste and temperature as some would do there will be five distinct perceptions of space, each of them capapable of translation into the terms of another sense only by the unity of consciousness, and this may make them a common sensible, or an abstract conception according as we suppose each sense capable of re-

ceiving the spacial notion of another, or inferring it from certain qualitative marks of its own suggesting a common relation and abstracting the individual differences. But we may consider the senses entirely independent of each other in the perception of space, or as capable of a common perception of it. In the first case empiricism and nativism may be divided upon each sense: or they may be divided upon one sense and agreed upon another, according as each does or does not hold the apriori exclusion of the other upon logical grounds. In the second case, the complications will vary with the extent of the connection between the several senses. There will be an opportunity for comparison between the senses. Thus a man might be a nativist in touch and an empiricist in vision, or *vice versa*: or a nativist in touch and sight, and an empiricist in hearing, taste and temperature; and so on with other combinations. It is no longer a question whether the idea of space is original or acquired, but whether tactual, visual, auditory space &c is original or acquired.

Second, we may separate space into its dimensions and regard them separately as objects of perception and they may be considered in reference to the individual senses; or in connection with two or more senses. Thus we may divide nativism and empiricism within the domain of a single sense; or on the same dimension between two senses. Supposing that different dimensions bear different relations to the same sense, or the same relation to different senses; and the same dimension different relations to different senses, we may have one or two dimensions natural to one sense and acquired to another; or one dimension native to one sense and the other two dimensions acquired to it and vice versa as the case may be. Thus we may suppose plane dimensions, including length and breadth, native to tactual perception, and the third dimension acquired. Again, we may look upon the third dimension as acquired to vision, but the other two dimensions native to it: or look upon plane dimensions as native and common to tactual and

visual perception, while the third dimension may be regarded as acquired to both, or native to one and acquired to the other. Again we may regard direction, or the third dimension native to hearing and plane dimension acquired. In taste plane dimension may be native and the third acquired: so in the sense of temperature we may regard all as native, or acquired: or plane dimension native and the third dimension acquired, or _vice versa_. And so on with the muscular sense: and with their several and mutual comparisons. But the analysis continues with a third distinction.

Third, not only can theories be divided upon the dimensions of space, but also upon the question of definite and indefinite space; or the _quality_ and the _quantity_ of space and its dimensions: that is, upon extension or commensurable quality in general, and localization in space in particular, or definite distances and quantities of commensurable extension. Space without reference to particular distances is one thing, and

definite quantities of it are another. A man may be a nativist with reference to the former and an empiricist in the latter without necessarily contradicting himself. Hering's view illustrates this.* Indefinite space may be apriori and definite space empirical because it implies reference to a standard which may or may not be the psychic constant of that sense involved in the act of perception. In fact it may be urged that most of the disputes which rise between nativism and empiricism are due to the failure to observe this distinction and may be reconciled by supposing it. Thus a man may be conscious that distance or space may exist between himself and the object of perception, but have no judgment at all as to the relative amount of it**. The constant by which a definite conception of space is obtained may in part or in whole be determined by the qualities of some other sense than the one interested: or the sense

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* Stumpf. Ursprung der Raumvorstellung. p. 166

** Abbott. Sight and Touch. p. 7

conceived may not have possess a constant within its own activity to which its various experiences are referred for measurement. Still it may be natively qualified to perceive and know something which may be made definite by comparison and experience. The whole case can be put thus briefly: a definite conception of space always requires a psychic constant, indefinite conceptions of space do not require it. For instance, the distinct existence which sight has as independent of touch will show that a natural origin for the notion of space by touch will be no direct proof that it is native to vision: nor again in another supposition will its empirical origin in respect to the actual quantities of space which are at any given time the object of perception in the least prove that the notion of space as commensurable quality is experiential or the result of experience in any sense like the former. We have only to look at a distant landscape to find proof and illustration of this.

We may introduce still another complication

already considered in a partial manner; namely the distinction between the idea of space as a common sensible and as a proper sensible. What may be determined with reference to one may not be true of the other. That is, one may see reason to suppose that space as a proper sensible, as an object of an individual sense or senses visual, tactual &c is native and still hold that the identification of space perceptions between two senses, as a common sensible or transference is empirical and due to experience. Perhaps it may be thought that the reverse of this cannot be true as it would give the appearance of making an apriori product depend upon an empirically given content. But with the proper understanding that apriori functions are not necessarily limited to sense perception, and may characterize thought even in cases where the matter furnished it is purely empirical, we may hold an empirical theory of proper sensibles, that is, visual, tactual, auditory space &c, and still maintain that the power to generalize them into a common

sensible is native and not acquired. This is nothing more than the recognition of a law of thought, admitted by every form of empiricism, and which is the native condition of the results gained by the comparison and generalizations of experience, but does not owe its existence to experience. However we state this at present only as a possible way of viewing the question. Thinkers were always divided upon this question because the notion of space taken in all its applications seems so complicated a conception. In this respect it is quite in contrast with the other sensibles which have been uniformly regarded as only proper sensibles. No one has ever thought of regarding color, sound, taction &c. as common sensibles. The question regarding their nature and origin was discussed, and a settlement of it expected only within the province of the particular sense of which each was an object. Even association if it ever has any power here, is of very limited range. But it is not so with the notion of space. Whatever may be said

of it in the individual senses, its character as a common sensible whether native or empirical, or the readiness with which it can be transferred from one sense to the experiences of another makes it more difficult of investigation than those which cannot be perceived by more than one sense, or cannot be transposed; because it is involved in more distinct phenomena than the proper sensibles of any single sense, and undergoes so many modifications in the same sense or senses differently related, that it must divide speculation directly in proportion to the number of elements in it and the number of relations that it sustains.

The only possible conclusion from such an analysis of the notion of space and the possible mental attitudes regarding it is, that as long as legitimate distinctions can be drawn between different elements of the problem, so long can there be a legitimate difference of theories regarding the question, and proof for one case cannot be generalized for different cases.

Thus as long as philosophers admit that the sensation of the third dimension in sight is distinct and independent of the other two dimensions in the same sense, so long will it be consistent logically to be an empiricist in one and a nativist in the other. The same illustration can be made in reference to the distinctions between definite and indefinite conceptions of space; and between the several kinds of space as compared in the different senses. The only alternatives of speculations are, that one theory must entirely supplant the other in all cases; or both have a relative legitimacy. In the first, each theory must pursue its explanations throughout every possible element of the problem, each on the assumption that the two theories are mutually exclusive. In the second case they are not regarded as mutually exclusive, but each distinct element of the problem is considered on its own merits aside from apriori assumptions one way or the other regarding the logical relations of the two views.

The following outline will tabulate the results of our analysis, and illustrate the complicated relations of historical speculations upon the problem.

Genealogical theories on the genesis of the notion of space.

- With reference to space as a sensible
  - As a common sensible
    - Concrete
      - Native
      - Empirical
    - Abstract
      - Native
      - Empirical
  - As a proper sensible
    - Native
    - Empirical.
- With reference to the kinds of space known
  - Indefinite = Qualitative
    - Native
    - Empirical
  - Definite = Quantitative
    - Native
    - Empirical.
- With reference to the dimensions known.
  - Plane dimensions
    - vertical
    - horizontal
      - Native
      - Empirical
  - Solid or the third dimension
    - Native
    - Empirical.
- With reference to the organ knowing it.
  - Visual space
    - Native
    - Empirical
  - Tactual space
    - Native
    - Empirical
  - Muscular space
    - Native
    - Empirical
  - Auditory space
    - Native
    - Empirical
  - Internal space
    - Native
    - Empirical

&c.

The analysis can be pursued farther for each sense by taking up the various characteristics in the notion of space; but we shall apply it only to the two senses of sight and touch for illustration and subsequent use.

Theories of the genesis of the notion of space with reference to the organ knowing it.

- Visual Space
  - As a super sensible
    - Native
    - Empirical
  - With reference to special characteristics.
    - Dimensions
      - Plane
        - Native
        - Empirical
      - Solid
        - Native
        - Empirical
    - Kinds of space
      - Indefinite
        - Native
        - empirical
      - Definite
        - Native
        - Empirical
- Tactual Space
  - As a super sensible
    - Native
    - Empirical
  - With reference to special characteristics.
    - Dimensions
      - Plane
        - Native
        - Empirical
      - Solid
        - Native
        - Empirical
    - Kinds of Space
      - Indefinite
        - Native
        - empirical
      - Definite
        - Native
        - empirical

3rd Analysis of the implications and associations historically connected with the conceptions involved in the terms 'apriori' and 'empirical' or "experience".

The analysis presented of the notion of space, and the possible divisions of the two theories show us how much must be considered in either theory in order to satisfy the requirements of the problem. What we ordinarily mean by space is thus seen to be a very complex notion, and hence the particular aspect of it must be taken into notice when deciding upon the theory we are to adopt in explaining its genesis. We have seen, upon the assumption that empiricism and apriorism or nativism were simple and clearly defined conceptions, that the many distinct elements involved in the general notion of space will not allow us to argue from conclusions regarding the one to conclusions regarding another: but that the controversy between each theory must

be decided upon the merits of each individual aspect of the problem under consideration. That is, we cannot argue the conclusions of tactual space in favor of either theory, nor the same conclusions in the case of visual space; or the conclusions regarding the third dimension to prove the same views concerning the other two dimensions: this of course upon the supposition that we must distinguish between the kinds of dimension. And so on with all other aspects of the question.

But thus far the analysis rather shows the extent of the problem, and does nothing to limit it, or to reconcile the opposing theories regarding it. It remains thus to indicate the proper limitations of the theories themselves, and thus, if possible to limit the field of real and legitimate controversy between them. If this can be accomplished, there may be a way to mediate many of their disputes and bring the real issue into comparatively narrow and well defined limits, and the problem simplified. This we hope to do

by examining what has generally been implied by the conceptions "apriori and "empirical.

The two conceptions are, perhaps, universally taken to be contradictory: they have been employed in many old philosophic discussions to indicate diametrically opposed positions. But although this is the case as regards particular systems, they have had different significations in various systems; so that there may be points of agreement in some of their implications. In some cases however the opposition between them is well defined and legitimate. For instance it is common with many empiricists to construe the apriorists position etymologically, and thus to define nativism as defending the existence of the notion of space before experience. Apriori is taken in its temporal sense to denote antecedence to experience, while experience is used to denote the first and original states of consciousness, or the individual states of consciousness at any given time viewed independently of any relation to any other state of it.

Hence if apriori ideas are to denote states of consciousness before the first states of consciousness they are manifestly absurd. Empiricism holds that it is impossible to have any knowledge before experience with which knowledge begins. In this conception of the problem, we submit that there can be no question about the rationality of empiricism. But it is a sufficient refutation of such a view of the case to say that no apriorist, whatever his language, ever meant to imply that apriori ideas were antecedent to the first actual perceptions as being ever realized, and it has only been the modifications which the conception 'experience' undergoes, that has ever lent plausibility to such a position. Taking experience to mean, not original and simple perceptions, but the developed effects of repeated acts of simple knowledge as it does mean in one of its applications, it is easy to see how certain simple ideas may be *antecedent* to them, and hence apriori in relation to that so-called experience.

There is no inconsistency between intuition and experience in such cases. If no other questions were involved they might coexist side by side and instead of coming into conflict with each other, be mutually supplementary.

It was the philosophies of Locke and Kant that gave vigor and warmth to recent controversies on the subject. Now, as we have removed from empiricism the necessity of antagonizing the Kantian view of the subjectivity of space, we wish farther to limit its opposition to that philosophy by showing that its usual conception of what Kant meant by "apriori" is a complete misunderstanding both of that fact and of the nature of the problem. If we cannot remove the antagonism entirely between Kantianism and empiricism, we may do much to show where the two have no reason to be inimical, and to define the real issue between intuition and experience. The key to the question will be found in Locke's and Kant's conceptions of 'experience.' Locke meant by it sensation which he

regarded as an ultimate fact of consciousness. Of course in this conception of the problem apriori ideas in their etymological sense were out of the question. But Kant while defending the apriori position in general did it in revolutionizing the conceptions of both "experience" and "apriori". Although Kant uses the term experience apparently in its accepted sense, it is only to adapt himself to the controversy in question, and to construct an ad hominem argument against the Lockian philosophy. But when he comes to explicate his own position, it is very evident that he does not consider experience a simple product. Locke had wished to derive all knowledge from experience, meaning by it sensations, (excluding reflection at present because it has nothing to do with the problem of space.) But Kant wished to show the necessary conditions of experience, apriori in the sense that they were given elements of it in its simplest historical form and anticipated in any developed form of it subsequent to the first states of consciousness,

at least in respect an external world. They were thus conditions that were constituent, not antecedent elements of experience. We confirm this exposition of the case by a statement from Lotze*.

"Kant's investigations", says he, "are completely distinguished from those of Locke without his anywhere expressing himself so. He did not mean that we can discover the origin and validity of our knowledge merely by experience and inner consciousness. He does not content himself with its actual origin which any one can observe for himself in a empirical way; but he demands to know the conditions under which it can originate." The same view of the case is given by Hamilton** This determines also his conception of the term "apriori. Although using it at a time when the Lockians construed it to mean historical antecedence to experience, and when its accepted

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* Lotze Grundzüge der Geschichte der Philos. § [illegible] 2.

** Hamilton's Edition of Reid's Works. p. 762

import in Logic and Metaphysics was a method of reasoning from cause to effect, or from self-evident propositions to positions as truths implied in them, we chose to denominate by it those conditions of knowledge, which although not historically antecedent to experience, as actual products of consciousness, and although first elicited in consciousness on the occasion of experience, were nevertheless independent, not of the occurrence, but of the content of that experience for their existence. An apriori element, therefore, in that system is a "given" element in experience, constituting it as it is, and not a subsequent development out of it, or a factitious generalization from it.

Such a conception of apriori or native elements in knowledge must modify the whole attitude of empiricism. For, it is forbidden to interpret the Kantian view of it after the analogy of conceptions against which the Logic of Locke was so effectual, and hence has to limit its consideration of the problem to the question whether certain ideas are found as a necessary and constituent element of experience,

or a subsequent and adventitious development from it. If empiricism is consistent with the idea that certain notions are concomitant in their origin with those usually denominated experience, then it may say with Kant that these certain notions, so of space and time, are given in it, that is are experience, and will have no quarrel with apriorism.

Kant's position grants all that empiricism had urged against the old conception of apriori as antecedent to experience, and hence empiricism can have nothing to oppose to Kant, unless it shifts its ground and endeavors to show that space is not a necessary element of our experience, or that it is a subsequent development of it. The latter of these two positions is but another statement positively of what the former is negatively, and is a corollary of it. If empiricism admit that the idea of space is involved in experience, it will have to exhibit some fine intellectual analysis if it can distinguish its position from that of Kant: for the supposition that an idea

is a part of what empiricism assumes to be ultimate and original is so nearly identical with the conception which Kant has of space as an apriori element of knowledge, that a distinction will be very much like hair splitting, and a dispute very much like pertinacy. Besides such a conception would hardly be any more in keeping with the general spirit of Locke's philosophy than the view of Kant, because Locke intended that all derived notions should be subsequent to experience. To grant that an idea is ultimate and original is to give up empiricism which stakes its whole existence on the derivation of ideas. Their derivation means that they are subsequent to the phenomena from which they are developed. Hence to return to the assumption that the notion of space is a part of experience is to abandon the proper method of empiricism, and to approach, at least, the position of Kant, from which it can deviate only by saying that the idea of space is an experience. But then it cannot oppose the Kantian view, because

as we have shown, Kant's problem to determine the conditions of experience itself. Kant will have no controversy with it as to what is experience; and as empiricism either stops with experience and refuses to investigate its conditions, or conceives apriori conditions to mean antecedence to experience, it cannot properly object to a view which claims the constituent elements and conditions of its own ultimate data, abandons the etymological conception of apriori, and assigns it a concomitant function with experience.

And again there is another way to show that empiricism mistakes the position of Kant, except when it is consistent enough to adhere to its own proper principle that the derivation of the idea of space implies its subsequence to experience, and even there the two may have a conception in common as will be shown. But the first point to be made is that empiricism so frequently, perhaps almost uniformly, interprets Kant's language in a historical not a logical

sense: that in its conception of apriori predominates with the notion of time in relation to experience. Thus Kant assigned the conception in relation to experience a purely logical function of necessity, antecedent rationally, of course, to experience, but actually as an element of consciousness concomitant with it. But the main thing which he wished to express was that the idea of space was a necessary constituent element of experience, whatever might be said of the time of its appearance in consciousness. Hence empiricism does not approach the question in discussing it in a relation of time: it must refute the necessity of the idea of space as a part of experience, and make it but a contingent element of knowledge.

To make this clear we submit an analysis of the conceptions possible with the term apriori.

Conceptions of the term 'Apriori.'

- Historical
  - Antecedence to experience. Locke.
  - Concomitance with Experience. Kant.
  - Subsequence to Experience. Scholasticism
- Logical
  - Necessity. Kant
  - Self-Evidence. Kant. Universality

the recognizing antecedence to experience as purely apriori and discriminating it — Scholasticism. We mean to state the idea that certain conceptions are deduced from antecedent ones, apriori in that they are derived in an apriori manner. This was a favorite method of Scholasticism. But aside from this it is evident that the opposition of empiricism to nativism is governed almost entirely by the historical conception of the term '*apriori*', or the idea that it denotes only a relation of time to experience in the order of the appearance in consciousness of the notion under discussion; namely, that of space. But as the stress of Kants position is laid upon the logical aspect of the term, and the notion of space as a necessary constituent of experience, and carefully excludes its antecedence to it, all limitations of its relation in time to experience, unless it is made subsequent and contingent, is purely negatory and fruitless. It does not face the real issue in this manner. Now, to summarize the whole question in order

to see clearly the limitations of empiricism, and also those of nativism so far as it is in contradiction with the same.

First, empiricism cannot object to Kantian apriorism in the doctrine of space on the ground that it implies the antecedence of that idea to experience, because Kant explicitly renounces any such supposition*.

Second, the assumption that the idea of space is concomitant with experience is in precise agreement with Kant, in the historical conception of apriori, and hence there is no reason to oppose his view, if empiricism is to admit that fact.

Third, the supposition that the idea of space is subsequent to experience implies one of two things:

(a) That it is a necessary deduction from experience.

(b) That it is a contingent resultant of experience.

If it supposes the first, that the idea of space is

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* Kritik der reinen Vernunft. p. 36. Hartenstein 1853.

a necessary deduction from experience empiricism both contradicts its postulate that experience can take place without the idea of space occurring*, and introduces the logical conception of apriori held by Kant; namely, necessity; – the necessity of the idea of space – while it was opposed to oppose the Kantian view. Hence the only possible course to be taken in order to oppose Kant is to adopt the second of these implications, which is the proper and characteristic one to define empiricism; namely, that the notion of space is a contingent result of experience.

This brings us therefore to the proper issue between nativism and empiricism, and the only one in which mutual opposition is possible. In all other points they must either be agreed or entirely independent of each other. Hence all questions are eliminated from the problem as between the two theories, except the questions regarding the necessity or the

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* Ribot, German Psychology of To-day, p. 78. Translation

contingency of the idea of space. So far, therefore, as most of the elements of the Kantian view are concerned, modern science and its empiricism are performing a supererogatory work of opposition in antagonizing it. Every question is irrelevant except in one whether the idea of space is an adventitious product of experience, or not. Both theories must be limited to this issue. Any other implications will only introduce confusion into the problem.

There will be much to analyze in this conception of the case: but the constant elimination of irrelevant issues, or of elements in which there is either conscious or unconscious agreement has very greatly simplified both the conception of the Kantian view so as to make it less objectionable to science, and the real issue between nativism and empiricism. It remains, therefore, to determine the conceptions of "experience" and its limitations as we have that of the term "apriori".

The two conceptions which have excited most of the mischief and confusion in philosophy are the terms "intuition" or "apriori" and "experience"; and both are alike impeachable for the offences and controversies to which they have given rise. They have uniformly been assumed to express conceptions which are mutually opposed to each other and no doubt in the individual minds taught to so consider them they are so, or seem so, simply because they are conceived to be contradictory. But assuming that they are contradictory to a single consciousness accustomed to conceive them so, it is by no means thus proved that the conception which one mind may have of the term "apriori" is contradictory to the conception which another mind may have of the term "experience". Their necessary contradiction can only exist to the mind that conceives them so: if all minds thus conceive them alike they will, of course, be universally contradictory. But if they are not conceived alike by all minds

They *may* be consistent, when the wider conceptions of two minds are compared and the contradiction may exist between the two conceptions of the same term. Contradictions are always in thought, not in words. Hence when different minds have different conceptions of these terms it is incumbent upon us to assume the possibility of reconciliation between them in every sense but that particular sense in which they are supposed contradictory in the same mind.

The different conceptions which we have already shown the term "apriori" to have had in the history of philosophy, and those conceptions of it which we have shown empiricism has no obligation to attack, indicate a way to mediate controversies which only serve to bring philosophy into disrepute, and none more than the speculations about space, our idea of it, and its genesis. What we have to ascertain concerning the conception of "experience" and its implications is designed to mediate between these two opposing views entertained as to the genesis of

nativism and empiricism; or to reduce the limits of their contradictions to the smallest possible compass. However the present discussion is to be no defence of transcendentalism, even if the method employed and results obtained seem condemnatory of empiricism. For it is easily possible that the disputes between the two positions are mutual misunderstandings, or that the general terms chosen to characterize their separate methods are ill suited to the purpose. Hence, although we shall not mean to present a defence of apriorism, especially at a time when the universal passion is for empiricism and against apriori principles, we shall have as the object of our analysis and criticism the demonstration that empiricism is no more satisfactory an hypothesis than the one it is so zealous to supplant. It may be that no satisfactory theory is possible. Whether that is true or not we have not to say. But we are certainly under no obligations to suppose that empiricism is the only choice when nativism is dismissed. The laws of intellect

which may not apply to nativism and empiricism. The disproof of one is no proof of the other as is the case in mutual contradictions. Hence our analysis must not be taken for a defence of one theory absolutely as against the other. Nativism may be entirely unsatisfactory: but it may be made as clear that empiricism is as far from the solution of its problem as the much hated apriori theories. This we mean to maintain.

Empiricism, as it is chosen to denominate the whole theory of knowledge, and as it may be used to characterize a class of speculations about the problem of space, expressly founds itself upon experience. Indeed it is meant to be a synonymous term for that idea: empiricism implies experience. As a theory of knowledge it means, in its own phrase, that all knowledge is the result of experience, or originates in experience: and this way of considering the matter is designed to contrast its method and source from that which regards knowledge, as some [illegible] of

represent it; independent of experience. Most men will wonder why any sane mind can question the origin of knowledge in experience. The denial of empiricism to such a mind is like the denial of an axiom. The appeal to experience is so strong and convincing to most minds that few can have the courage to resist it: one feels that he is exposing his sanity to impeachment if so plain a truth is considered open to question. Why is this? There is a good answer to this question, and it is that experience is supposed to be a very plain simple conception.

Few of men take the trouble to inquire or to state what they mean by experience. In no author or discussion that we know of, spiritist or empiricist, is there a scientific account of what that conception imports. It is assumed to be a clear and simple notion that everybody understands, and of which there can be no question. Nobody seems to suspect any ambiguity about its terms. But as a fact it is one of the most comprehensive conceptions ever introduced into [illegible]

and philosophic thought. It will do in common and practical life where there is neither the necessity nor the demand for clear, consistent and universal principles, nor that accuracy expected of science and philosophy. All that is wanted there is some conception good for general practice, and no exception will be taken to its usage because mistakes and illusions may occur under the espionage of such notions. But when we come to philosophic thought which demands for its fundamental conceptions that freedom from ambiguity and misunderstanding which characterizes its very aims as opposed to the uncritical methods of common life, there is no excuse for choosing a terminology which makes no distinctions between truth and falsehood. If experience is to be the universal and final appeal of philosophy its meaning should be single clear definite and unmistakable. If it be a general term comprehending several individual and distinct conceptions, there is no telling in which of them it is the basis of knowledge:

much more fatal to the propriety of using it, would be the fact that it comprehended contradictory states of mind. Whether it does so or not we shall see.

It is not a definition of experience that is most needed: at least, not a definition in the logical sense. The very conception that it has in the minds of those who would make it the ultimate appeal of reason might forbid or prevent a definition of it: indeed it may be impossible to define it by any notion simpler than itself, and certainly it cannot be the last foundation of knowledge, and at the same time be subject to a definition which could be admissible to empiricism, since to resolve it in this way would be to give it up as the ultimate source of knowledge. But whatever may be concluded about the necessity of a definition of it in the logical sense, it will not be easy to choose any conception which will appear clearer and more intelligible than the term itself. The universal acceptance of it is apt to guarantee certain forms of human truth, whatever may be said of its possible obscurity, will

vouchsafe it a certain validity that seems beyond the possibility of weakness or of doubt: so that an attempt to define it and to indicate just what it means as a criterion of knowledge may only confuse instead of satisfy the ordinary mind. But there is a course open to us that will show how its indiscriminate usage has been productive of nothing except confusion in philosophy. This is to state the implications of experience. To state the implications of experience is to state those particular and divergent applications it has had in the history of thought. Just in the proportion that they have been various and divergent will its usage as a philosophic principle be weakened and dissociated. Has it any such implications as will weaken its function as a basis of knowledge?

The answer to this will be found in the historical conceptions of the term which defined its function in speculation. The object of both parties all along in history, the apriorists and the empiricists, has been to set up something, one of them apriori principles,

and the other, experience, in order to distinguish between what was true and what was false. In purpose, therefore, the two views are at one. Now the question is, whether the one or the other involves any contradictory elements that will emasculate its essential functions. We have already insisted, that if the term *apriori* is taken to mean ready made principles antecedent to consciousness, but still forms of consciousness, the theory of nativism must be frankly abandoned. But is any such weakness to be discovered in the conception of experience? We think that a greater weakness can be found.

In the first place the term *experience* is used in so many and in such different connections that it is hard to ascertain what it means anywhere. It is this generality of its applications which makes it so difficult if not impossible to define it satisfactorily for our purpose. We speak of experienced mechanics, experienced teachers, physicians &c; we accredit their abilities and their knowledge in certain directions to their

'experience'. If they have had no experience we are slow to impose any confidence in their opinions about the subjects respecting which the possession of experience is the criterion of their power and fitness to do certain things. But again we say that certain ideas, habits, customs, usages &c 'are only due to experience. The difference of opinions about things or of conduct and action in certain cases, we say, is due to a difference in the experience of the individuals. One man has one experience concerning a given case, and another man a different experience. One has the experience that the temperature is very oppressive, and another notices no disagreeable feelings from it, and hence has no such experience as will enable him to affirm the same statement as the first. One man experiences a religious feeling as he looks at the heavens; another sees nothing but the mechanical system of Laplace: another, perhaps, instead of feeling any reverence excited in him experiences only a feeling of dread, of fear and super.

stitions. The experience of one man in looking at a landscape is a feeling, exactly involved by the artistic character; that of another it may be but [illegible] only for a desert in which no agricultural facilities are possible. How would such persons agree in in their general accounts of it? Could the artist and the farmer in this case both use terms of unqualified admiration regarding it; unless they both thought of it from the same standpoint?

Again we find men employing experience to denote the fundamental elements of knowledge, and define it to be sensation: thus experience means sensations, and these are regarded as the same in kind for all individuals. To experience a thing, therefore, is to have a sensation: or in the case of internal mental states, it would be to have a state of consciousness. These are supposed to be the elements out of which knowledge is developed.

Still again, experience is used to denote every imaginable complex state of knowledge comprehending

the whole contents of what the mind may be conscious at any given time: or it may thus denote the developed and matured resultant of many sensations and individual experiences; and even the abstract complex of different sensations. This is very different from its identification with single isolated sensations.

Another signification has been given it by those evolutionists who are so afraid to use a single word that an opposing theory ever employed. Hence we hear of inherited experience by which they mean that one being inherits the experience of his ancestry. We are not told whether it means inherited sensations or not: but in order still to cling by the language of empiricism we find it so used. Its relation to the question at hand will be seen at another time. It is sufficient to have stated and defined the different uses and relations expressed by the term experience, before examining its fitness to define a principle of philosophy, or to serve as the basis upon which to explain knowledge.

edge, and in particular the origin of the idea of space.

By comparison of these several meanings we shall be able to discover two that are diametrically opposed to each other. The one is the reference to experience as the basis of all knowledge and certainty or of confidence in certain qualifications; and the other is the reference to it to account for the considerable differences that we find in human opinions, conceptions and customs. In this respect, the notion, experience, is surrounded with precisely the same difficulties as the term belief, which, as Herbert Spencer* well expresses it, has the misfortune in the history of philosophic speculations of denoting both "the most coherent and the least coherent of our states of consciousness." Thus some philosophers have endeavoured to base all knowledge upon belief, asserting that the ground of our ineradicable assent to all axioms mathematical and logical, and metaphysical principles

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* Essays, Moral & Political. The Test of Truth pp 384–388 Am. Ed.

like cause and effect. Here the ground of judgments and conceptions characterized by the qualities of certitude and necessity is affirmed to be belief. On the other hand, the term is used indifferently to denote the lowest degree of conviction, in cases where we have no assignable reason for the state of mind regarding the question. Here belief is made the ground of such assent as is not only without the characteristic of absolute certitude, or thought necessity, but also may denote nothing more than a possibility, or the lowest degree of probability.

It is precisely so with the idea of experience. We use it in some cases to express the strongest criterion for the validity of our mental states, and in others to indicate the contradictions which destroy their validity. On the one hand we say that all our knowledge originates in experience, and in order to prove the reasonableness of any assertion we appeal to the universal experience of man. On the other, we say that one man may have one experience and another the opposite experience, and yet talk about experience as being the determinant

of truth in these cases. How experience can prove contradictions at the same time is not explained. It will not do to say that knowledge is relative to the individual and that the experience may be anything consistent or inconsistent with that of another at the same time, or with the same agent at different times. For the question is, what is the criterion of absolute and universal or common knowledge. Of course, there may be no such thing. But the assumption that experience proves it relative and that what may be true and valid for one man be false for another is simply an admission of the claim of apriorist that experience is no criterion for objective knowledge. The apriorist need not stake his objection to experience upon the ground that there is, or must be absolute knowledge: for whether there is or is not the problem is whether experience can give such a result or not. If experience be the criterion of knowledge, and if it be also granted that it may be inconsistent or as Protean in its shapes as the colors of the chameleon, then it does not prove

and it is not qualified to serve what is demanded of it by the dissident. Its aspects are therefore revised amid its assessment [illegible] of it. Hence the meaning of the appeal would be not that experience is the basis or source of knowledge, but that knowledge comes only of experience.

But aside from every question whether knowledge is either relative or absolute, it is impossible to use the same criterion to express the strongest and the weakest of our states of consciousness. We cannot say that experience is the proof of all that we are certain of, and then turn round to it is not valid, as we do when differences of experience are used to disprove the validity of certain ideas connected with them. That is we cannot say that experience is uniformly and universally valid, and immediately point out the contradictions in it to disprove the validity of ideas which it produces, and so show the untrustworthy nature of our beliefs so originated.

It is just this impossibility of a simple and definite meaning in experience that has excited the opposition of most minds against empiricism. Few of our rational minds can be induced to pay homage to a criterion which can be used alike to prove or disprove the validity of any given notion. It is a strange criterion of knowledge that can be used to prove it false or true at the same time. Apriorism would raise no objection to empiricism but for this insuperable difficulty. No doubt the special conditions which empiricism includes in experience is correct enough and in all the ordinary matters of thought and action it would serve an adequate purpose. But its liability to exception, and its historical usage which [illegible] every form of contradiction take it entirely out of the category of principles capable of exercising scientific accuracy and proof. Now in order to see the fact and the great extent of these implications in the term experience let us notice the history of speculation and the inherited conceptions it has left us.

We take the first implication which the conception received from speculation: it is that it may denote any event in the thinking states of an individual without reference to the consistency of one with another. Now it is true that the term "experience" used to denominate this idea is of comparatively late origin; but the conception itself and the animosity it awakens is an old one, and is a very good example of what we have already remarked, namely the tendency of language to gather up and conserve in human thought whether in the same or different terms, the whole results of past speculation about important questions. If conceptions were certain to change all their implications as certain aspects of their comprehension were changed, perhaps no difficulties would arise. But there is a kind of immortality in every idea which can secure an embodiment in general terms, and it has the tendency or disposition of an inclusion or comprehension of thought just in proportion to the wealth and variety of its comprehensiveness. This con-

relation which attained early in the Greek experience and which is involved in many, if not all, forms of its application is due to the philosophy of Plato and Protagoras. It thus stimulated an opposition that is as perennial as the problem itself.

Previous to the time of the Sophists both common sense and the metaphysical conceptions of the Eleatics taught the existence of something eternal and unchangeable. This they regarded as true for nature for knowledge and for morals. Upon such a belief was reposed all the confidence possible. Its foundation, at least in most minds, was an uncritical acceptance of the data of sensation, although from time to time before the Sophists, and for interested purposes in reference to special metaphysical theories, philosophers had thrown out statements impeaching the testimony of the senses. Many causes, which cannot be enumerated here, worked to give stability to this instinct, until finally certain actual illusions in the judgments of sense confirmed the general principle of the Heraclitic philosophy. Pro-

Pyrrho and his followers founded their theory of the relativity of knowledge upon the fact of these illusions, and in the spirit of Heraclitus pointed in the deliverances of sense to the characteristics of changeability and capriciousness. The sceptic observed that water might be hot to one person and cold to another at the same time, or to the same person at the same time, if only it affected different parts of the sensorium under the proper circumstances and conditions. Similar illusions were observed by the Greek mind in respect to quantitative relations or ideas of greatness and smallness, and perhaps many other variable phenomena. Upon facts of this kind two doctrines were founded. __First__ the relativity of all knowledge, and __second__ the untrustworthy nature of sensation for any objective knowledge. With the first we have nothing to do except so far as it is connected with the second. This second doctrine was the one which determined thought about the conception of sense history in Greece. The sceptic assumed that the

generally accepted opinion of the age that the senses were the only source of knowledge. But the contradictions which he was able to demonstrate in the judgments thus effected enabled him to show that sense perception was not reliable for the opinions or general truths affirmed by the common minds and philosophers alike. The deliverances of sense and perception, or the judgments formed upon the occasion of stimulation, which we have called experience since the time of Locke, were shown to be of every possible kind and difference, and even in some cases to be contradictory. Experience therefore in the language of modern times was declared to be a conception which would include every form of difference and inconsistency. Sense perception could be no appeal to prove a general objective rule or principle. Hence the conception which we express by experience was accepted as the criterion of variableness and inconsistency: it was the essential argument against any uniformity and regularity.

The Platonists with their master, in replying to the Protagorean theory, and in proposing their counter-theory of ideas which was their expressions or opinions admitted without reserve the untrustworthy nature of senseperception, and proceeded to characterize it in just as reprehensible terms as would define the view of the sceptic. They granted that sensation, or experience was no valid authority for universal truths. But they set up certain ideas which they conceived as independent of experience. This position succeeded in defining a clear opposition between the Protagorean or empirical, and the Platonic or a priori theory of knowledge, and in fixing a mode of expression regarding native ideas which has shown more persistency in that connection than the doctrine itself; namely, that these ideas, or a priori principles were independent of experience. It is this expression that seems so objectionable to modern thought and that subjects Plato and his system to the severest ridicule and the most unfair attacks of some-

ern thought. But we have only to examine it relatively to its time and purpose in order to recognize its truth and consistency for Plato. Its meaning for him was not what the modern empiricist with his changed conception of experience generally supposes. To Plato experience was identical with the changeable, capricious and irregular and was a function of sense: universal truths, or general conceptions which he regarded as opposed to the flux of phenomena he conceived as independent of experience. This is simply a truism for him. It is self evident that a power which gives uniform and universal conceptions must be different from and independent of one whose function is to deliver only individual and changeable states. The former was independent of the latter merely because permanence is independent of change. There is no use to find fault with supposition because it is implied in the very terms of the proposition. If any objection is to be raised at all it must be by denying

the *fact* of universal ideas, not their independence of individual and changing phenomena, because this characteristic is implied and assumed, or admitted in the fact of their existence, as affirmed or granted. If the fact is once admitted, that there are ideas not subject to the changes, inconsistencies and merely individual character of sensations, their independence of such characteristics is assumed with the fact, and hence relatively to the conception which it involves I suppose the phrase "independent of experience" is a legitimate one. It should present no difficulty to any mind except such as have changed the Protagorean and Platonic conception of experience. As a matter of fact this has changed: in many minds it is the complete reverse of that, because sense perception and its deliverances are accepted as valid testimony to reality. But at the same time that it has changed for some minds when denominating facts of this kind, it has still retained in general the signification which early philosophy gave it. As we have shown we are

the conceptions to denote the experiences not changeable; so much that it may cover differences and inconsistencies which nullify any appeal to it as a criterion for truth: but now we see also that the intention of the conception "independent of experience" as applied to ideas opposed to the changeable comes into conflict with a very different conception of that term, and parties lose sight of the real issue by fighting about words. If they only took the trouble to define themselves carefully it might be easy to show that both parties are right or that both have precisely the same result in view.

The opposition between the two theories has propagated itself through history while the ground of it has not done so: or has done so in one of the conceptions of experience, while it has not in another. A similar phenomenon can be observed in the history of the opposition between faith and reason. If once the environment of a particular age or problem determine the mode of conceiving and formulating it and its solution, that conception will be a traditional inheritance of long-

wage as long as human existence requires that problem to be considered. The success of Platonism in its general conception of the theory of knowledge, if not for its truth absolutely, certainly for its practical usefulness in affording a basis for thought and action, a success that is marked by the following which the theory has commanded ever since Plato, especially in the period of Scholasticism and among the immediate predecessors of Locke has had the effect of giving more or less permanency to the Sophistic and Sceptical conception of sensation or experience. The human mind until the time of Locke, except such as were followers of Aristotle was saturated with the idea of the fallibility of experience, until it became a by-word for that notion, and in certain connections so retains it, that, whenever one wish to express the liability to mistake and error of any idea, we say: "*It is only the result of experience*". In such cases the conception of experience is used with the implication that ideas dependent upon it are not necessarily valid on the ground of that origin.

Suppose we apply this conclusion to the idea of space. If we are to assume the notion of "experience" which we have just commented upon and to trace to it our idea of space and thus deduce its origin, the fact that experience guarantees no validity to its dependents but on the contrary can even imply that a conception originating in it is invalid, is more or less an impeachment of the validity of our notion of space, a result which empiricism is the first to protest against. Its principal objection to the Kantian position, as we have indicated, is that it denies the validity of one of our strongest convictions; namely, the validity of our judgment regarding the objective nature of space. But as experience in the conception we have explained is no guarantee of that validity, and as difference of experience showing contradictions and inconsistencies are used to disprove the validity of any judgment ascribed to it, There is no reason to suppose that empiricism can be any more successful in proving the objective validity of our idea of space than Kantianism.

This may be irrelevant, however, to the question of its origin, as its origin in experience may still be conceived, whether it is valid or not. Still it is well to involve empiricism in a real or possible contradiction by virtue of its conceptions. But farther, in as much as the Platonic conception of experience was that of contingency and inconstancy, it was of something which could have been otherwise, and much more contingent were the resultants supposed to be dependent upon it; so that they can easily be conceived as merely hap-hazard consequences in the flow of phenomena. They might not have taken place at all. Experience as experience being anything whatever does not necessarily imply these resultants, and if these resultants might have been different as they are only contingently connected with experience we must conceive these resultants and among them the idea of space both as an idea that might not have existed with this experience, and as less in logical extension than experience, that is, experience can take place without the idea of space ever having

my existence. By thus making the idea of space a contingent resultant of experience it is classed with the contingent associations connected with the same conceptions and phenomena in different minds. We refer the difference of resultants, or connected associations to the difference of experience in the two cases showing that experience as such is no absolute guarantee of the desired result, and may be appealed to for opposite consequences. Now, if the idea of space is common to opposite experiences they are subordinate to it, and so far as experiences are contingent and variable phenomena the common idea of space cannot be traced to them: because by supposition of the Platonic notion of experience it affords no common or universal characteristics. Hence having none of those it must be classed among the contingencies of experience which by supposition validates nothing and has no necessary connection with the idea of space, making possible both the validity and the non-existence of the idea of space. To neither of these does empiricism assent.

It is just this fact that experience can be made to prove anything at all whether contradictory or not that has justified in Plato the appeal to something innate, it for ideas whose validity and universality had as strong support as the existence of individual sensations whether relative or not. So far therefore as that conception of experience has continued to exercise its influence upon existing thought has apriorism been justified in denying the sufficiency of such an origin for ideas containing elements which are not found in their source. This has been the chief objection to empiricism and the chief support of apriorism. It is easy to see from the changes which have taken place in our conceptions of the case how the two views may be reconciled. But it is enough at this point to hint the conditions upon which nativism is defensible, and they are when the conception of experience includes not only contradictory data, but also represents no common characteristics such as it must represent if it is to be the source of universal ideas. Of course, it may be

replied to this that common experiences could produce common ideas. But the answer to this is that the Protagorean and Platonic notions of experience insisted that it could never be common to two individuals and was never identical for two moments of time in the same person. It, therefore, lacked every power to produce the universal ideas of Plato and the common sensibles of Aristotle. We must not lose sight of the fact in this argument, that the notion of experience under consideration contains by the admission of both the sceptic or empiricist and apriorist of the time in which it originated, absolutely no elements by which it may legitimate or validate a single permanent idea. That agreement makes the theories logically and formally consistent with each other as regards the relations involved between certain facts and their origin. The real point of difference and contradiction, as long as the Protagorean and Platonic philosophies decided the mode of conceiving the problem, has been regarding the nature of the facts, and not the way of accounting for them, if supposed.

Wherever sense perception was distrusted, as it was in all Platonizing systems of philosophy, the a priori conception of the problem was a necessary one, and it so far agrees with modern empiricism that both make the same fundamental assumptions regarding both the nature and the validity of the idea of space, so that from the purely relative conception of experience there is no alternative to rationalism. But modern difficulties, which occur at once to consciousness, arise from the fact, that the assumptions of the original conceptions and of the opposing theories founded upon them have long survived the changes which have rendered that opposition valid and necessary.

We, therefore, turn to the second conception of experience which will afford at least some vindication for the positions of empiricism. There are three things to be noticed in the historical analysis which is to unfold this second aspect of the question.

1st The general motives which prompt to an empirical view of the problem.

2nd The Aristotelian element of the problem as affecting the conception of experience.

3rd The Lockian element and its influence.

Taking up the first of these, we have the fact that, in the course of history certain modes of thought came to be considered as opposed to real facts of observation, and could not be confirmed by that test. Some minds had either endeavored to transcend what could actually be perceived, or could face the paradox, if not the contradiction of supposing something which was not a positive object of knowledge like a mental state or a sensation, and yet affirm it to be the most certain element of knowledge. Whether they really meant to imply any such conception may be questioned; but at the same time, the language employed was calculated to leave just such an impression, and certainly many speculations, claiming to be the legitimate result of positions so assumed, carried the mind beyond anything that could be made

reasonable or intelligible. The natural reaction was, of course to return to a defensible position and to keep affirmations within the limits of what could be definitely known and communicated. This course is true of every period, reacting against transcendentalism, from the earliest times to the present. Experience, therefore, or empiricism arose as a protest against opinions that were chimerical and illusory: even if they were admitted to have a legitimate existence, it was not such as could be made intelligible to all minds according to accepted standards of clearness. But clothed as they were in terms that were necessarily ambiguous, and in many cases formulated with express opposition to the most palpable and obtrusive phenomena of conscious knowledge; namely sensible and self-conscious affections with irresistible convictions about their depths, they easily deviated from methods that were disposed to make every statement coincide with fact before admitting it. Empiricism in every age has received immense accessions of power and pres-

tage from such overwhelming triumphs as its dependence upon facts secured for it over the method of apriorism with its deductive speculations.

The transcendentalism of the Eleatics, the Pythagoreans and of Plato and echoes of some of the Atomists were occasions in ancient Greece for the advance of empirical methods as they appear in Aristotle, the Epicureans and some of the Sceptics. Similar reasons influenced Bacon and Locke to supplant Scholastic by empirical methods. In both cases the time had arrived for clearing away the superincumbent mass of idle speculations and fanciful theories that had grown out of the neglect of facts. But we choose Aristotle to represent the first of these reactions in favor of empiricism, not because his position was wholly new; but because his was the empirical, as Plato's was the apriori, endeavor to answer the scepticism of Protagoras and his school, who were really the first to make the problem a necessity. Aristotle had before him, therefore, the same problem as Plato.

We have seen that Plato's answer to scepticism and its conception of sense perception, was an admission of the last fact, but a reconstruction of the theory of knowledge from an intellectual point of view. But Aristotle attempts the answer to scepticism by a new conception of sense perception. Instead of admitting with his master and affirming with Protagoras the necessarily untrustworthy nature of sense perceptions, he draws the distinction already dwelt upon between common and proper sensibles and assigns to the senses both an absolute and a relative function. The testimony of sense-perception was to be accepted as objective for common sensibles, and subjective or relative for proper sensibles, but trustworthy in both cases. He returns thus to the view of common sense and adopts in answer to his sceptical opponents a view of experience directly the reverse of Plato. It was admirably supported by his view of common sensibles in addition to the irresistible prejudice for accepting the deliverances of sense. But the important and

permanent conceptions which he contributed to thought in the matter, or supported by his example and great reputation, was the validity of experience both as a criterion and as a source of knowledge. Aristotle distinctly affirmed and maintained that all our knowledge comes with the senses and that nothing could be traced to deliverances antecedent to sense perception. The position was so reasonable that sober and practical philosophy could not well deny it. It at once emphasized an original condition of all knowledge however complex and cumulative it afterward became. This prominence which it received from being an original condition of knowledge gave currency to a conception which we express by saying either that knowledge originates from experience or that knowledge depends upon experience. Although Aristotle may not have meant to identify simple sense perceptions with the notion of experience as he otherwise defined it, the fact that he held sense perception to be valid for knowledge, as Plato did not, and the fact also that knowledge began with it, had the ef-

fect of giving currency to conceptions that were very crudely embodied in experience, or implied by it in the post-Lockian notions of it. This doctrine, in respect to both the validity of sense perception and the origin of knowledge in it, remained side by side with Platonic conceptions in the history of thought, and gave in the end a directly opposite and contradictory meaning to the conception of experience as compared to the one already presented and traced to the authority of Plato, and the Sceptics he tried to answer. It is very plain that the two notions must give difficulty in speculations that could not admit a criterion containing a contradiction in its applications. Still the conception given by Aristotle's theory of perception to the problem of knowledge is a permanent concomitant of what we mean by the term "experience" in certain connections.

The third element which has entered into the conception of experience in the second sense of its application is that derived from the philosophy of Locke. He affirms with Aristotle that knowledge begins

with sense perceptions and the consciousness of our own mental states: but he very much simplifies the conception which that philosopher had called experience and which we have to discuss as the third meaning of the term. He identified experience with "sensations and reflections', or a knowledge of our own mental states. The latter not being especially relevant to our problem shall be omitted and we shall speak only of sensation and its identification with experience. Hence the position of Locke is that experience is sensations, or sensation is experience. Thus Locke defines experience and in such a way as to exclude many implications that at least some philosophers had supposed to be involved in it. Aristotle also had defined it, but in a very different way, as we shall see later: Locke, however, whether the first or not to do so we do not know, identified it with simple states which admittedly excluded all "complex 'ideas" as he called them, and in such a way as to make this experience possible without the necessity of originating these "complex ideas".

His object was to find the universal and necessary condition of all knowledge in such a way as to eliminate all ideas about which there were unsettled differences of opinion, and all such as could not be involved in the first sensations or "experiences" of the individual consciousness. In this way he reduced all undesirable conceptions to sensation: this was the only ultimate principle of knowledge, excluding "reflection" as we have done. General knowledge was the product he had to account for, and it was admitted by all parties that the whole mass of knowledge could not be "innate". Hence the question was: what are the irresolvable elements which are the first experiences of the mind, and out of which by abstraction, reasoning &c, all subsequent "complex ideas" are developed? The answer to this was to make experience the necessary element, and "complex ideas" the contingent element of knowledge: that is, experience, or sensation might take place through the whole living existence of an individual and not result in any "complex ideas", although if the latter ever occurred, they

were to be considered as *intellectual modifications of the original materials of sensation, but not extending beyond those data*. In order to vindicate such a view the author had only to ransack the minds of infants, savages and the like to discover that "simple ideas" were universal, while the "complex ideas" formed by comparison and reasoning were absent, or too infrequent to regard them as native to the human mind. The whole method of testing apriorism was that of finding what was first in the consciousness of the mind, and what must always be there in order to be native. If any beings were found in whom certain ideas could not be found, the ideas in question were at once supposed not to be native or apriori, in as much as the accepted criterion of apriorism was universality, and this failed in the cases of infants and savages, while they were not denied a classification with human beings to all of whom the doctrine of "innate ideas" was applied. It was, thus, but a plain way of putting the whole problem if the first data of knowledge in the order of time were sensa-

time from which the facts of consciousness must date their origin. Locke so succeeded in giving emphasis to the factor of time in the problem, and actual definite mental states and judgments that the questions of laws of thought, or mental principles were lost sight of and and the problem was merely an inductive one regarding the facts of the case. The greater question about the validity of our knowledge was tacitly left in the background, so that only its origin was a matter of investigation. As to what was historically original and native was largely if not wholly, a matter of mere fact and observation: he had only to exclude all elements which observation showed were not universal and the residuum could be safely assumed as ultimate and underivable. This he found in all cases to be sensation whose removal was the destruction of the subject or consciousness. This being the first factor of knowledge in the order of time, no other ideas could precede it as he claimed the doctrine of "innate ideas" had held: hence any conception

which origination from sensation was dependent upon it and must necessarily or contingently follow it. If necessarily it was a modified form of the original experience: if contingently, the experience could exist without it. In both cases however experience was the historical antecedent, and "complex ideas" among which he enumerates "cause" "substance" "relation" &c are the subsequent developments of abstractions. The supposition is that they are not found in experience and are not experiences, but are regressive inferences from them. Now two facts seem to give them less security than "simple ideas". They are, first the general assumption of philosophic thought at the time that only universal and ultimate ideas were absolutely certain; and second, the similar assumption that inferences are liable to error. The intellectual associations and implications, therefore, which had previously been connected with "complex ideas", as "cause" "substance" &c. as regards their validity because of their supposed universality was thus conceded to experience or "simple

ideas', and the mind's confidence and allegiance transferred to another authority whose associations were already contaminated with contingency and inconstancy.

These implications in the conception of experience are very important for the impulse given to speculation in trying to resolve many of the profoundest and irresistible convictions into contingent inferences from experience, and when empiricism found that its own existence was staked upon the issue of space and time as conceived by Kant, and which were granted to be ultimate by Locke, it was obliged to take up the deduction of those ideas from experience.

The position of Locke was implied by that of Aristotle, but not formulated in it. But all through the course of history from the Stagirite to the present, this recognition of the importance and priority of experience as against the Platonic conception constantly defined with more precision the controversy between empiricism and apriorism, although both shifted their ground in some respects and extended their conditions in others. How

the controversy was defined and what its limitations must be examined in order to see how Locke's conception of experience determines for us the way we are to investigate the genesis of the idea of space. We must understand the implications involved in the historical development of the opposition between two theories and the heritage of presumptions, associations and inferences it has left us. It is this, then, the *logical* history of the case alike applicable to every stage of the controversy.

The two theories divide upon the nature and origin of certain ideas. Apriorism begins with the position that certain principles, powers, or ideas like space, time, cause, number &c. are ultimate and universal, not reducible to sensation or experience, because it has none of the required characteristics. If proof is demanded, and if any attempt is made to bring them within the compass of ordinary reason dependent upon the standards of experience, apriorism is studious to deny the possibility of such effort terminating successfully, and hastens to define its conditions *by the abstractions*

or negation of all qualities which are grounded in empirical origin. It affirms that we must transcend individual facts in order to get at the real nature and truth of things, and proceeds from this to the position that the most certain principles of knowledge are the transcendental objects: universals, space, time, cause &c. or supersensible agencies. It is in this assumption that it creates the occasion for opposition. Empiricism in taking up the gauntlet is not concerned at first in denying the existence of transcendental realities, but only the assumption that they are the most certain facts of knowledge. It maintains that the first and most certain things in the order of nature and of knowledge are facts and that whatever else we attain is analytically deduced from them. Thus all [illegible] known causes are regressive inferences from facts which had to be known before, or at least as the conditions of all reflective knowledge. We begin with facts and reason from them to causes, principles, universal ideas &c.

There is an opportunity of mediation here, and perhaps it is possible. We may suppose the priority of facts to general principles as asserted by empiricism to import a logical priority, as explicitly announced in consciousness, while causes, principles &c are implicitly involved at the same moment of time in the total act of experience. This is really Kant's position, although his language, cast in the mould of an age more familiar with empirical conceptions pure and simple, seemed to conceal it. It was most likely the position of apriorists generally. But even if it be granted that there is no necessary contradiction between the two positions as thus limited, the statement of empiricism that the prius is fact, and of apriorism that it is principles would easily develop into hostility between them, because the very conception of prius suggests a historical rather than a logical relation. Ordinary intelligence soon loses sight of past problems as conceived then, and often at best can only interpret the language of traditional systems in an etymological manner. Mistaking the past

also that the question of one is the order of knowledge and of the other, the order of being, the conception of a priori will introduce confusion in almost any case, because in one of these it must be logical and in the other historical. Thus taken in the same sense controversy is unavoidable. But as we can most easily conceive and employ a priori to denote a historical relation and as the question rather pertains to the origin of certain ideas, the conception of genesis also implying a historical relation, philosophic thought readily accedes to the position that experience is prior to certain ideas supposed to be dependent upon it. The dispute then instead of being confined to what is logically more important in the content of knowledge is extended to the order of time in the matter of what is known.

Now it is precisely this notion of priority with its corollary implications as transmitted by speculation that creates an occasion for opposition from apriorism. Were it merely a question of historical facts as to the order of knowledge ex-

plicitly enunciated and formulated in consciousness, there would perhaps be no dispute. For it is a plain and incontrovertible fact that we do have experience or sensations historically antecedent to the enunciation of certain judgments about them whether analytic or synthetic. Besides the mode of conceiving experience as the historical prius to certain inferences from it is very much favored, if not necessitated, by the confessed fact that we may say, that sensation or experience can take place without calling into existence certain ideas, while these ideas cannot exist unless experience takes place. There is an answer to this: but nevertheless the mode of statement whether rightly or wrongly, does actually exercise an influence in favor of the empirical conception of the problem. Still the objection of apriorism would not be raised against the mere priority of experience to the conscious formulation of its involved contents. Its hostility is directed against those implications of the empirical method which afford no guarantee either as to the necessity or

the validity of the inferences drawn from experience. That these implications are involved in the position of Locke is very evident from his own argument and from the historical development of his school. Whether the implications are legitimate or not is another question: we are concerned only with the fact of it and it must always be remembered the conclusions from an assumption is not in the least altered as a historical fact by the illegitimacy of the assumption. It is enough surely that the mind has taken for granted certain ideas, or conducted its reasoning as if they were true. We must see therefore how these implications are involved in Locke's conception of experience.

It is a universally admitted principle of logic that no necessary, or necessarily valid inference can be drawn from premises or conditions that do not implicitly contain it. The inference as an explicit state of consciousness must be potentially contained in the experience: otherwise it has the

character of a gratuitous assumption. As an assumption it may at some time turn out to be true but it will be due to the testimony of experience, and not to its valid inclusion in the first instance.

That we could not necessarily infer from experience complex ideas not implied by it was most clearly shown in the history of the discussion causality. Locke affirmed that experience presented only coexistence and sequence of phenomena. It is plain that the mere fact of temporal coexistence and sequence does not contain the notion of necessary connection which is implied by the idea of cause. If not so implied what legitimate right have we to so infer it? It may be supposed as a mere hypothesis if we choose: but if the only material of the experience be a relation of time, it is absurd to infer _analytically_ what is not contained in the premises. In addition to this, if we suppose, as Locke and his followers do, that experience, or simple sensations and simple "reflection" states are the

ultimate test of validity and universality or necessity the very fact that the notion of cause is removed from the category of "simple ideas" of experience would include that it wants the accredited criterion for its certitude and validity. It was [illegible] instead and empiricism not only provides no evidence for it, but the general manner in which it attached the taint of certain "complex ideas" on the assumption that they did not have in their support the testimony of experience, implied, and has created a wide spread belief that a suspensive veto must be applied to every conception which is not a modification of experience.

If experience contains only sensations and consequently ideas are adventitious inferences or generalizations from it, they have only the validity of guesses so long as they are not necessarily involved in the data from which they are inferred or separate, and so long as these data are taken as the criterion for certitude and necessary acceptance in the mind. The notion of cause, or necessary connection not be-

ing given in experience by the supposition of Locke's philosophy, it could not be rationally and necessarily deduced from it. Hence we find empiricism in his most consistent followers holding that the notion of cause & necessary connection is an illegitimate inference from the premises, and reject it & set up as the substitute for it, and as the limit of our knowledge the doctrine of invariable association & invariable coexistence and sequences merely as historical facts which the future may reverse.* We content ourselves with references to prove that this interpretation of the case is correct.

This reasoning is very valuable for the two implications involved in the conception of experience; implications which every historical discussion

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* Hume. Treatise on Human Nature. Part III. Sects. II. to VII.
J. S. Mill System of Logic Bk. III. c. V Sect. 2. & 6; c. XXI. Sects. 3 4. 5
Dr. Thomas Brown. Inquiry into Relation of Cause & Effect. Part I Sect. 1.
Herbert Spencer. Principles of Psychology. Vol II pp [illegible]
Am. Ed.

various criticisms and revisions has carried along with it since the time of Locke. They are:

1st The idea that experience may exist without including or guaranteeing the necessary existence of "complex" or abstract ideas.

2nd The idea that experience is the only valid test for the validity of our knowledge which as possessing absolute certitude and universality is distinct from isolated sensations or states of consciousness.

The very fact of talking about the origin of certain "complex ideas" of knowledge and not about the origin of experience, conveyed this impression. The very notion of origin involves a beginning in time, or a coming into existence of something which had no existence in previous time. Experience was assumed to be an ultimate fact which could not be derived from any similar phenomenon, and hence knowledge had no reason to analyze it. To originate from experience was, therefore, was to come into existence after the first instance of it, either as

necessarily implicated in it; or as a factitious inference from it. If necessarily implicated in it then 'complex ideas' were given in it only to be elicited into consciousness on the proper 'occasion': if only a factitious inference, there was no necessary connection between "complex" and "simple ideas". But it was expressly denied that "complex ideas" like that of cause, substance &c were given in experience, or sensations, and since the only course of thought was to exclude them from the category of necessary ideas and to assume that experience would go on forever without implying them. Not being implied in experience or its contents they were not modifications of it, and hence could not be like it. They were distinct in their nature and came into existence on the occasion of experience as their mechanical antecedent. It was always seen thus in seeking the cause of a particular thing or event. The object was to find some antecedent that contained no element of it and that might exist without

the consequent. Otherwise its *origin* had not been determined. For instance if we sought the origin of sensation we did not seek an antecedent which was made up of the sensations in question, because the same inquiry could be made of this as the former case, and to proceed with an infinite regressus of sensations of the same kind, or even of sensations of any kind, would not reach an *origin* for sensation in general. When we regard vibrations as the cause of the sensation of sound or of color, we have an antecedent that does not necessarily imply these consequents with its existence. Under the other conditions they may *necessarily* produce, but they are not implied in the very existence of vibrations, which may go on forever and no sensations of sound take place. We trace the origin of water or of combustion to elements which have none of the properties of either of the resultants. And so with everything whose origin we wish to deduce. Hence when we endeavor to trace the origin of "complex ideas" to experience we mean that experi-

ence shall not contain these ideas, but shall be independent of them and be capable of a continued existence without their production. If they are found as constituent elements of experience, we have failed to deduce their origin, unless we push the question of genesis into that phenomenon, which empiricism does not undertake. To have an origin therefore in experience or from experience, as supposed by empiricism, imports that the antecedent contains none of the elements that constitute the consequent: otherwise its origin, as we have shown in the idea of cause, is not effected.

We have only to take up the special idea of space to illustrate the application of this principle to our problem. Locke admitted it was original, as it was a datum of experience. Not so with the idea of cause, and we have already seen how empiricism has been forced to exclude the notion of necessary connection from the category of legitimate conceptions, reducing it merely to invariable coexistence and sequence. Now if once we raise the

question concerning the origin of our idea of space, it is at once excluded from being an experience so long as we endeavor to trace its origin to experience. For if we consider experience ultimate and its origin irrelevant to a theory of knowledge, and at the same time regard the idea of space as a constituent element of experience, we have not supplied the antecedent required in the supposition of an origin to that idea in order to account for it. Because, if the antecedent contain space or the notion of space we have not found its genesis. The only alternative before us, therefore, if we are going to trace its origin to experience, is to find some experience not containing it and which can be shown to be its invariable and necessary condition while preserving at the same time that independence which will enable it to exist without involving or implying space. If any antecedent presupposes it, we have the infinite regressus which excludes every conception of a genesis. That it should be so is not the claim of the apri-

nist alone, but is admitted by the empiricist. The argument and assertions on both sides imply this assumption. But that it may be made more certain we quote from two empiricists. First we take a passage from Ribot; he says:

"The great, almost inevitable error, that is inherent in almost every theory of space, consists in confounding the solutions of the problem with its data. We never free ourselves from a petitio principii; to explain space we always employ elements that contain this idea." * And Wundt ** when explaining the notion of space as a "psychical synthesis" of elements not containing it says:

"We may understand by this expression, the especial combination of peripheral sensations, with feelings of central innervation, whence results an order of first data in space. For the idea of synthesis

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* Ribot. German Psychology of To-day. p. 78. (translation)

** Wundt. Physiologische-Psychologie Vol. II p. 28.

ordinarily has reference *to new properties in the product which were not present in the constituent parts.* Just as in the synthetic judgment a new predicate is attached to the subject, and as a chemical synthesis is a combination with new properties, so the psychical synthesis gives, as a new product, an order of sensations in space." The arguments of J. S. Mill and Mr. Bain are conducted upon the same assumptions[*]: and both are empiricists.

But before discussing the importance of such a position for limiting the conception of experience as taught by the empirical school and its effect upon the whole problem, we shall examine the question by another method which will reach the same conclusion as above, and which will show both the points upon which empiricism and apriorism are or can be agreed, and the very limited field in

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[*] Mill. Examination of Hamilton. Vol. I pp. 273 – 307.

[*] Bain. Senses and Intellect. Eng. Ed. pp 304 – 4[illegible].

which their mutual opposition is legitimate.

Viewing the whole question in the relation of time, and assuming the Lockian conception of experience, we may say that the origin of the idea of space may be conceived in three possible ways.

1st As antecedent to experience.

2nd As concomitant with experience.

3rd As subsequent to experience.

Neither theory regards it as antecedent to experience in the sense of Locke, nor antecedent to it in the sense of Plato, the first conception we have given it, but independent of that. But in the conception above assumed both are agreed. Apriorism regards it as a concomitant, constituent, and conditioning element in experience. Empiricism cannot assume the idea to be concomitant with its data for two reasons.

1st There would be no deduction of its origin, but make it an ultimate datum of intelligence.

2nd There would be no ground of opposition to apriorism

The empiricist cannot call it an experience as it would be if it was concomitant with sensation, because he wishes to consider it the result of that experience, and the result of it in the sense that no elements of it are contained in that product. Hence it cannot originate from experience upon the supposition that it is simultaneous with it: and much less could experience be independent of it upon the supposition that the two were correlatives in the same moment of time. For clearness, then, it has no alternative but to suppose the idea of space subsequent to experience, if it is to have any ground of difference with nativism. If it maintain either of the first two suppositions the two can unite in a common cause. But if nativism can never maintain itself upon the supposition that the idea of space is subsequent to experience and if empiricism can support itself upon no other, the two will be in irreconcilable opposition until one or the other is proved. Yet there are points in which nativism

may assume that the idea is subsequent to experience, and so far agree with the postulate of the opposing views. This will depend upon the following conditions:

1st That the notion of space is a necessary result or consequence of experience.

2nd That the notion meant by empiricism is the mature and developed conception we have of it in every particular as opposed to indefinite extension as the germ of it.

3rd That the conception meant by empiricism is the subsequent and explicit enunciation in consciousness of what is involved in the total of experience: that is the conscious recognition and abstraction from that whole the element which did not receive explicit attention in the first case of experience.

The last two conditions define exactly the position of apriorism. For they admit one of them that there is a germ of indefinite space, and the other

that the conception of space is implicit, in the original experience. The admission of such conditions would make the two theories unite at once: for as a fact the position of nativism as regards these special features of the problem is, that there is a germ of developed space, or the implicit notion subsequently formulated in consciousness, concomitant with experience, and that the developed and consciously distinguished notion of mature is subsequent to the simplest form of experience. The two theories can be opposed only on the condition that empiricism denies _in toto_ the existence of any element of our idea of space, implicit or undeveloped, in the original experience. This would imply that the first condition could not be admitted by that theory. Besides, for an additional reason it is evident that empiricism cannot admit the idea of space to be a _necessary_ consequent of experience. If it were a necessary consequent, experience could not take place without calling the idea into existence. But

this is contrary to the requirements of empiricism whose very conception is that experience is possible without certain "complex ideas and among them that of space when it is to be regarded as derived. We have already shown that the origin of an idea means its beginning in time after some antecedent which is capable of existing without the notion derived from it. Besides if any interval of time be supposed to exist between the antecedent and the consequent, it is a contradiction to suppose that the former cannot exist alone and without the latter, which fact is only another statement of the truth that the interval of time necessary to make the idea of space subsequent to experience contradicts the supposition that experience necessarily originates the idea of space because of its own existence. Hence the supposition that the notion is a necessary consequence of the existence of experience is only an expression for distinguishing between the implicit and the explicit conception of space in our

mental states, and this makes it only a logical, not a historical subsequent, and hence really a concomitant with experience, both of which suppositions are the postulates of nativism. Besides it is a fundamental claim of empiricism that there are no necessary ideas, but that all originate from experience, which may make them anything it pleases. Hence in so much as empiricism can neither regard the notion a necessary consequence of experience in the strict historical sense, nor suppose it is or a necessary idea, it has no alternative but to assume that experience is an independent antecedent of the notion, and that the latter is a contingent resultant of the former, if it is still to continue opposition to nativism. The only course to adopt in order to create an issue with nativism is to hold that experience can take place without necessarily calling the notion of space into existence. We have shown that origin of the idea from a phenomenon which contains no element

of the resultant postulates the very thing. The whole discussion therefore, must concentrate itself in this one question.

It was this conception of the problem to which Locke's notion gave currency, and it was due to the representation of experience as simple isolated sensations without any necessary implications, and as the only objects of positive knowledge. Even in the so-called experience of maturity, all additional and adventitious products had to be subtracted, or abstracted, in order to find what was the proper experience. Hence the habit of saying "*only the result of experience*", when we wish to impeach the credit of data that are not themselves that process; while in another connection, we say "*only experience*", when we wish to impeach its credit as a criterion for the validity of its results or concomitants. This is the point where the Lockian and Platonic conceptions of sensation contradict each other. But aside from this, we now

in what setting the logical and historical development of Aristotle's conception of sense-perception and Locke's limitation of experience to that phenomenon minus the usual implications supposed to be involved in it, have given to the problem, and it is one which the speculations of empiricism since Locke have tended to confirm and invest with the impression that every mental conception additional to sensation or experience, may be a doubtful one, not being by supposition identical with the assumed criterion of existence. There may have been no intention to do so, but the necessary consequence of its opposition to apriorism, whose avowed object was to sustain such a position, inevitably surrounded it with such associations and enabled the counter-theory to persist as a complementary effort to study and vindicate mental states and conceptions whose validity empiricism confessed its inadequacy to determine and explain.

Side by side with the conception that experience denoted single and isolated sensations or individual states of consciousness without any implications involved in them, there has grown up a third notion of it, and it sometimes lies concealed in the statements of those who are in general trying to confine themselves to the simple Lockian conception of it. This third conception was given it by Aristotle in a positive definition.* As already shown his notion of sense-perception and the origin of knowledge from it created Locke's definition of experience; but the Stagirite set afloat a very different notion of it, which largely prevailed in philosophic thought to define its attitude in various problems, and to mould expression in them, and which has not been supplanted by the simpler notion of Locke. The Greek ἐμπειρία was not the simple conception that empiricists after the

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* Aristotle. Meta. A. 980 b. 21
  " Analytics. post. II 19. 100, a, 2. [illegible]

Grecian type used to express: it denoted or included memory and the results of repeated acts of knowledge. In the first passage to which we have referred, Aristotle says: "Men obtain experience (ἐμπειρία) from memory. Many acts of memory (or reflection) regarding the same matter of fact result in a single experience." Almost the same language is repeated in the "Analytics", the second of the references given.

But its purpose here is to illustrate a complex conception of experience which has been used all along through history to express a very complex idea, although so generally intelligible from the circumstances in which its usage appears as to render definition of it difficult; at least in any short-hand way. But its main characteristic is that it implies repetition and development, or the accumulated product of time and exercise. We say an "experienced" carpenter, teacher, scientist, laborer and what-not, to indicate not a person who has isolated sensations or mental states; but one whose thoughts or actions, being

actions, or knowledge and powers in general, represent an accumulation of facts and their interrelation in the course of the man's history that make up what he can command at any given moment for thought or for action. Hence it implies the whole content of consciousness at any given time that such a state exists, including with data and inferences from them in the same comprehensive act of mind. Thus we may suppose that the first states of consciousness are without any of the notions of time, space, cause, subject, object &c. explicitly recognized and distinguished as separable elements of those states. We may call these experiences, as isolated sensations, or mental states, calling them such because they have actually taken place. When these earlier states are repeated we find them inextricably involved with the notions of time, space, cause, substance &c. and yet they are or constitute a complete state of consciousness; and with all the additional elements of intensity, change of time

in place, and comparison with other states we may and so call this comprehensive whole an experience because it has actually taken place, and because all the elements constitute a single product in the same individual moment of consciousness. Accordingly we are accustomed to say, that the experience of a trained scientist when he sees a new animal, or a strata of rock is very different from that of a savage at the same time although the simple sensation is the same in both cases: likewise we say the experience of an educated man in the presence of music, of pictorial art, or when reading a literary production is different from that of an illiterate man although both have the same sense-impressions. We say also that a mature man has more experience than a child, when we mean, not that he has had a greater number of sensations of precisely the same content as the child, but that he has more knowledge. We speak of having learned certain perfections and accomplishments by experience,

as in the arts and sciences, when we mean that it is by practice, not that the most legitimate and certain elements of those perfections are the simplest and most original sensations. And in this sense we often think of certain after-products in our constitution and character as "the result of experience", or that it "depends upon experience", "originates from experience" &c. Experience in such applications is a very complex thing: it will include all sorts of judgments and inferences, made to interpret facts, or to enlarge the circumference of mental vision. We can in this sense speak of all our inferences as experiences, and also in a more accurate sense, we do name the verification of repeated acts of perception and knowledge by the term experience, in which is meant nothing more or less than the certitude derived from repeated and verified observation. Thus it is itself a perception.

Now if in this conception of the term we wish to say that the idea of space is derived,

the whole aspect of the problem is changed, whether we regard the developed or the undeveloped notion of space as involved in the problem. If an experience denotes the whole content of consciousness at any period of existence, and if we mean by an origin from experience that the product originated must be experienced in consciousness, there will be no dispute, or ought to be none, between nativism and empiricism. For no doubt our developed notion of space has received its definite character from just such a process as repeated perceptions. In using the phrase, "originate from experience", or "depend upon experience", to account for the genesis of our idea of space, when we mean by it, successive and accumulated perceptions, and that the notion in question originates from actual perceptions we have the phrases of empiricism, and the actual thought of some forms of nativism. For, to say that our notion of space originates with, in, or by experience, when we mean that it is an element

is the compound result of many actual perceptions, or that it is the product of actual states of consciousness as opposed to the conception of its having been antecedent (apriori) to perceptions, is only to say with the nativist that it is given in the fundamental constituents of consciousness. That is, we conceive the idea of space as an experience, not something that historically or even logically precedes it. This way of conceiving the problem is in contrast to that which would make an idea prior to actually having known it, and is only to say that knowledge begins with perceptions to which there can be no objection. The important question is as to what is given in it.

But we see from this third conception of experience, how it is even possible to suppose that the idea of space actually precedes and conditions experience, as some forms of nativism are accused of holding. For if experience denotes any given state of consciousness with all its contents,

or if it involves acts of memory, inference and judgment, the idea of space must condition every definite judgment or inference made about the relations of external objects, and hence might be spoken of as apriori in the etymological sense. To call it apriori in this sense would not in the least contradict its origin in experience taken in the sense of Locke. It may thus be an actual experience like all perceptions or sensations and yet be the historical and logical condition of that complex knowledge or conception which Aristotle called ἐμπειρία, or experience. Hence, with such qualifications, to say that it did not originate from experience, but was its antecedent and condition, was only to use a mode of expression which empiricism as understood to-day could readily accept. It might have been that very conception of experience; namely, that it was preceded and conditioned by certain elementary functions of consciousness or of knowledge, which gave occasion

to the notion of _apriori_ ideas in the historical sense: they could easily have been so if experience appeared as a subsequent mental product. But it was easy to deviate from such a conception of it when the priority of sensation to all knowledge was made prominent and when the mind gradually adopted the view that an experience was what had actually appeared in consciousness. In that case the 'temporal or historical sense of apriori, as a condition antecedent to something else, would have to be abandoned. Hence rationalism would be forced to surrender a mode of expression, such as "independent of experience", or "before experience", which would be legitimate enough under the circumstances in which it was originally used. But the expression has remained while the original conceptions have shifted positions, and it becomes difficult to adjust them without endangering important implications

made to depend upon them. And still the change of conception was not wholly an inversion of the old. In as much as experience was, on the one hand, regarded as a complex whole of consciousness constituted by certain original elements, and on the other, was identical with the idea of what had actually been elicited into knowledge, and would denominate any state of consciousness whatever, it was natural to speak of the original mental perception as an experience, and at the same time regard it as a complexus of elements, as original and as native as Locke's sensations. The question of the origin of any idea was, therefore, pushed back as far as possible in the history of the individual. The manifest absurdity of continuing the conceptions of apriorism when they would import an actual state of consciousness before the first state of consciousness, compelled the adoption of the only alternative expression, that certain ideas previously supposed to be apriori

were originated in experience. There was nothing to prevent the assumption in such an expression of the complex nature of experience, or that all elements in it were original and not to be reduced to any simpler state of consciousness. Hence the "result of experience" or "origin from experience" was only another way of saying that an idea was an experience. Thus the notion of space, in the view that experience was a complex whole, came into existence on the occasion of sensations or the original states of consciousness, and could be as original as they, and not an inference from them. With this conception of the problem empiricism and nativism could abandon controversy and come to agreement: and many philosophic discussions of the question under both these terms have just the conception of the case we have given it. They mean nothing more or less than that the idea of space is *an ultimate experience*.

But the spirit of the Lockian Philosophy, its

limitations of experience and ultimate qualities of sensations, and the necessary implications involved in the conception of origin, led empiricism to indicate that "complex ideas" had an element not given in experience: and although they traced their genesis to that antecedent, they had neither the nature nor the security of that which is supposed to originate them. The whole problem is, therefore, reduced to one of two alternatives by the spirit of that philosophy. "Complex ideas" and with them the idea of "space when ever it is subjected to the same crucial examination as they, must either be an experience, or the subsequent result of it. If the notion of space is an experience the conditions of nativism may all be granted in such a supposition, and there would be no ground of opposition between the two theories. But if it be a subsequent result of experience, every postulate of empiricism implies that it must be deduced from non-spacial data, and would

then make it a merely contingent element of knowledge, which rather means that it is an element that alters little, if at all, the nature and the amount of knowledge we have or can have. It, therefore, results in carrying us back to a time when we had no idea of space and when certain experiences or sensations existed without that element, and without implying that the notion of space ever need accompany them. This is the only conception of the problem in which any legitimate controversy can exist between empiricism and nativism.

But there is a fourth conception of experience which is used to preserve the empirical attitude against apriori theories: it is the notion of "inherited experience" or "the experience of the race". When empiricism is forced out of its usual position by facts that show the notion of space to be as original in its nature as any sense perception, or by reasoning which shows that spatial elements are [illegible]

ena are assumed in the antecedents proposed to account for the notion under consideration, it resorts to the shibboleth of "inherited experience" in order to avoid the humiliation of a surrender or an admission. It must still say "experience", if it has to push its occurrence back to a time when any amount of conjecture cannot be disproved, and when refutation is impossible merely because candor requires the confession of complete ignorance of what might have been anterior to any possible knowledge of the case. Empiricism should be the last to make such assumptions or assertions. For, a little examination shows that the evolutionistic conception of the case is mere thimble-rigging and logical jugglery, so far as it is an effort to refute nativism. Its doctrine may be perfectly true, as it also undertakes to trace the origin of experience, that is sensation and consciousness, in the same way; but it does not in the least meet the requirements of the problem as it is properly understood. In seeking the genesis of the notion of space, we are not endeavoring to go beyond the

consciousness or experience of the individuals in which it appears. What we want is its origin to consciousness in man, and not what it might have been in a Pliop. a hundred million years ago. Nativism has confined its object to the origin of the idea to man, although it has used the analogy of animal actions and experience to confirm its conclusions: the main question was whether the idea was original to man, and if any deviations from this special conception of the case were practiced it was only to find in a lower order of beings phenomena which illustrated the argument more clearly, but which must be conceived in all cases after the analogy of human experience. It is only so far as we are capable of knowing what animal experience is, that it can have any significance in the problem. When empiricism held that the notion originated in experience, and nativism that it was apriori, they both conceived experience to apply to man and his consciousness, and to [illegible]

mal consciousness only so far as it was like man's and had the same sources of manifestation as man's. But granting the opposite, experience in any intelligible sense of the term must mean certain mental states or conceptions _actually taking place in consciousness_, and to say that these are inherited is sheer nonsense, and merely dodges the issue. What we inherit is _capacities_, not experiences. We do not inherit states of consciousness, but capacities for it. If man has inherited capacities for the notion of space it is an original conception to him, precisely as nativism has asserted, and empiricism is wholly given up. We have no objection whatever to the supposition that experience may give rise to faculties not found in the endowment of the individual concerned; but the supposition that the race has inherited the capacity for an original and immediate knowledge of space at once abandons the claim of empiricism, that it is a derived element in the individual experience of every man. Nativism

is under no obligations to push the inquiry back of the consciousness of the individuals in whom the perception of space is found as a definitely known factor of thought. It is a question of experience as we know it: otherwise it is but a substitution of that conception for faculties and thus retains only the language of empiricism while it adopts the real thought of nativism. Such a miserable makeshift in order to keep up a controversy, or to keep up the semblance of consistency is not worthy of the name of science: not that we intend to uphold a theory of nativism as opposed to empiricism, but that both positions are legitimate with their proper limitations and that the only legitimate opposition between them regards a single point; namely, whether the idea of space is a subsequent and contingent development from experiences which contain no cognitive elements of it: whether as a cognition in consciousness it depends upon and originates from data that are non-spacial in their nature and power of [illegible].

The four meanings of the term experience which we have discussed may be summarized in order to see their different relations to the problem. The implications they involve will show at once how well calculated they are to excite controversy. They are:

1st Sensation as a subjective variable and contingent phenomenon without validity for either the object of perception or for the ideas made to depend upon it.

Plato

2nd Simple isolated states of consciousness, or actually realized mental states valid for the objects of perception, but implying more or less contingency for "complex ideas" derived from them

Locke

3rd Complex states of knowledge involving conditioning elements of simple perception, and including the increments of time, observation and exercise.

Aristotle.

4th Inherited capacities produced by the experience of previous individuals Spencer

Similarly we present the several meanings of the term *apriori* in relation to those of experience, so that we may see its legitimate and illegitimate applications, and the possibilities of agreement between empiricism and nativism. They are:

1st Perception knowledge *independent* of, but not *antecedent* to experience in the *first* sense.
(Antecedent in the Platonic sense of *Reminiscence*)

2nd An immediate and original act of knowledge *concomitant* with experience in the *second* sense, and not conditioned by it.

3rd An *antecedent* and conditioning element of experience in the *Third* sense, but itself an original perception *concomitant* to other elementary states of consciousness.

4th A *necessary* perception of knowledge, although it be *subsequent* to experience in the *first* and *second* senses; but necessary in the sense that it is analytically involved in those states but subsequently formulated in consciousness.

As a conclusion this analysis evinces the several possible conceptions of the problem concerning the notion of space and its origin, and the relative legitimacy of both theories regarding it. In some conceptions of experience we find apriorism the only natural one, and in others empiricism is the only one which can commend itself to reason and common sense. Many of the controversies between them have arisen from the retention of associations and implications with the general conception of the one theory, which the other with its associations and implications must oppose although the original conceptions of the problem which had given it its setting had either changed or passed entirely out of existence. The antagonism between between the two ways of viewing the question has continued long after the reasons for its origin have been removed. The analysis therefore enables us to eliminate all irrelevant conceptions in the problem, and to limit or define it in such a way as to comprehend the real question at issue.

1st We eliminate Kant's discussion of the ideality of space for two reasons, although it is one of the chief objects of attack to empiricism: (a) It is a problem of the nature, not the genesis of the notion; (b) It is irrelevant because its ideality is consistent with either empiricism or apriorism.

2nd We eliminate much of the objection to Kant's view of the apriori origin of the notion by showing that his conception of the question made the idea of space a constituent given element in certain experiences no matter at what period of individual development it appeared. It might appear long subsequent to certain other experiences historically and yet it was an original element to consciousness, which was universal and necessary to sense endowments as the special sense qualities. Hence the question of the time in which the notion appears to consciousness is more or less immaterial to the Kantian conception of the apriori: his main point is that it is a necessary idea when it appears.

3rd We eliminate all etymological conceptions and relations of the term apriori, and limit its import to constituent and necessary elements of experience.

4th We exclude every question regarding the metaphysical nature of the idea of space, and confine the problem to its gnosiological origin; thus making it largely a historical question.

5th We limit the legitimate question of dispute between the two theories to the issue whether the idea of space originates from non-spatial data, which have only a contingent connection with it.

6th We ascertain on the analysis of experience and the conception apriori that the real difficulties and causes of controversy do not lie in the proper import of those terms, but in the inferences and implications associated with them, and that are thus made to interpret them. Those deductive implications have persisted in connection with the terms in spite of the changes of the original conceptions which had legiti

mated them as interpolations, and come up as objections, as desirable ends to be maintained, whenever the two conceptions are made the comprehensive exponent of one side or the other. Hence the empiricist objects to the apriorist because of some logical consequences that he fears will be drawn from such a theory and the apriorist objects to the empiricist for the same reason. Each is afraid of some philosophical system that has actually been made to depend upon the assumptions of the other, and that history invariably finds associated with them; and hence each supposes that there is no way to avoid those conclusions, but to disprove or discredit the premises of the other. The notion that the two theories and the fundamental conceptions upon which they are founded, contradict each other, and are inherently opposed to each other is determined by the antagonistic nature of certain conclusions without stopping to inquire what the original data of the problem mean aside from historical associations. The chief

cause of controversy, therefore, is that we allow the historical associations of certain philosophic systems connected with the use of terms like "experience" and "a priori" to dominate our conceptions of those terms, rather than make an examination of the real mental phenomena which constitute their contents, and whose meaning cannot, in the least, be determined by a captious and ad libitum criticism of metaphysical theories. What is really needed to avoid confusion is a knowledge of the actual mental phenomena supposed to be embodied in the two terms chosen to characterize the two theories.

As long as the term "a priori" is understood only in an etymological and historical sense to import only an order of time in the existence of certain ideas, it will inevitably meet with opposition from the mind which apprehends the very natural and legitimate conception attached to the term "experience": and as long as the latter term is supposed to be no guarantee for general truths it will excite opposition from minds that must have a general conception to express, if not to guarantee,

their validity. What is needed, therefore, between parties to the controversy is a clear understanding as to the conceptions and implications meant to be expressed by their fundamental assumptions, so as to clear away and exclude illegitimate associations from the problem.

This is well illustrated in the historical analysis that has been given of the ideas variously expressed by the term experience. The four very different conceptions of it show very clearly what confusion can be introduced into all speculative thought by the failure to observe the distinctions unconsciously embodied and implied in the term and that open the way to complete misunderstanding. If we were when using the conception, conscious only of the one legitimate meaning of it, absolutely no objections would be raised against it: for the sifting process of reflection and analysis, and the legitimate demand that positive assertions about truth be restricted to what we have actually perceived and known rather than to rely upon a priori inferences and associations, there

tended to give 'experience' almost the same meaning as consciousness. In saying that knowledge originates in experience, we really mean that the final evidence of a truth to us is this realization of it in our consciousness, and not any thing that precedes it, nor inferences which may be constituted only by "separable associations". That is, experience means to us in its wider sense, the actual realization in knowledge or consciousness of certain ideas; and hence when a problem of the genesis of them is proposed, implying the temporal order of their appearance, there is no alternative but to examine what and what only appeared first in the consciousness of the individual. But if we ever imply that experience may be anything whatever, or that it is not a valid criterion for the general character of certain knowledge, we throw ourselves open to objection. No doubt the only rational test for a truth or an idea is experience, if we mean by this that it must be realized in consciousness before we can know it. But if experience may also imply that its data can

be perfectly inconsistent and contradictory, and that it is just as valid for one of these cases as for another, which means that it has no validity, then it presents insuperable difficulties as an ultimate proof of knowledge, which we feel obliged to assume as valid.

The various possible conceptions implied by empiricism and rationalism prove that they, in the terms, are utterly unfit to define the the characteristic nature of the problem unless we are able to exclude from consciousness those associations that instantly confuse the issues at stake and provoke controversy upon irrelevant questions. We must either define them accurately, therefore, or abandon them for conceptions that do not lead to misunderstanding.

Part II

Discussion of the Problem.

The special problem connected with the senses of Touch and Sight is that of a common sensible. There is no dispute about the peculiar function of the one to perceive tactual resistance and of the other to perceive colour: but there is dispute about the perception of extension. This question takes more than a single form, and investigators are divided as to the way in which it shall be presented. One class excludes from vision the natural function to perceive space, holding that the idea is derived by that sense from association and that the notion is a result of muscular or tactual sensations; the second class hold that it is the natural function of vision and that it is a derived product of other senses. If it is to be regarded as a common sensible at all in these cases, it must be only in the sense that the notion of space is so intimate-

is associated with the deliverances of other senses that as a part it is bound up with them in consciousness. Thus it may be spoken of as a common sensible in part at least of mature experience. But the opposition between the two schools defines more clearly the position that the notion is not natively the object of both senses at the same time and in the same sense. This is, however one of the main questions although every phase of the nativistic theories regarding the notion of space is by no means involved in the fortunes of the question whether it is natively a common sensible for both senses. For most of the nativistic theories have been connected with the sense of sight and in particular with the problems of binocular vision; empirical or genetic theories have had also the same province.

But before we can ascertain what our special problem is we must once more resort to an analysis, such as is implied by the various attitudes of historical discussion already discussed and outlined, and by the complex nature of the idea

of space. This will be to remove an apparent contradiction between some of the earlier and many of the later speculations about it. We have already indicated that controversy has been divided between the senses of touch and sight; one school making the idea of space the natural product of touch and the acquired product of sight, and the other school reversing this position. Berkeley maintained that it was of touch and denied it of vision: Sir William Hamilton agreed with this general position. And as between the two senses, if the notion must be considered as the natural product of the one there would be, it would seem, no alternative to the denial of it for one but the acceptance of it for the other. But speculations since Berkeley's time, although denying it in some cases as the native perception of sight, have also refused it to touch, and assault the position assumed by Locke, Berkeley and many others that it was a native quality of that sense. This is another important instance where conceptions have changed their comprehension: and

it is easy to show that there is no necessary contradiction between that school and those of the moderns who refer the idea to the muscular sense, or the sense of motions, not assign it to the sense of touch.

In the time of those philosophers the sense of touch comprehended all those phenomena which are now referred to three distinct senses namely the muscular sense, the sense of temperature, and the sense of touch proper, or of tactual resistance. It was assumed that all these functions were performed by the same set of nerves, and hence the position of philosophers then who referred the idea of space to touch would comprehend the position of those now who refer it to the muscular sense and in nowise contradict it. We have simply narrowed the meaning of touch, by confining it to one of the three phenomena or classes of phenomena which it once comprehended. There is therefore no need that men who favor the theory of the muscular sense should enter into a refutation of older theories based upon touch, for the plain reason that the conception of

touch has changed its meaning. They can leave entirely out of view the technical differences between the two periods, as they are absolutely useless to the discussion. It is comparatively recent that the muscular sense has been separated from the older view, or assumption that it was a modification of touch: and by far much more recent that the sense of temperature has been shown to be distinct from the same sense. The distinctions, however, have much to do with shaping the various theories concerning the notion of space, in as much as language has to be used according to those distinctions, and the notion of touch covered a much narrower limits than in various speculations. The contradiction is thus only apparent between the older and more recent theories

Nevertheless the distinct nature of the several senses formerly comprehended under the general term tactual will require the consideration of the problem in reference to each class of phenomena by itself. We

that purpose is designed to discuss tactual and muscular sensations more or less independently of each other. Hence we have to inquire whether the notion of space originates from tactual sensations, or from muscular sensations; or whether it is common to both of them. The opposite theory would ascribe it to vision and make it a derived association with tactual and muscular sensations for those senses. It is possible, as actually occurs in some cases, to make two dimensions native to vision and the third dimension derived of that sense by association with muscular sensations.

We are here introduced into the complications of several forms of nativism, and several forms of empiricism, which must be kept apart from each other: and they are much greater in number than is intimated by the mere question between sight and touch. This fact which our analysis has elaborated requires that the subject be canvassed in all its aspects and each individual problem involved considered in its own proper relations. In order to do this we shall

divide the consideration of the problem into two general discussions, as follows with subdivisions

1st The Criticism of Theories.

1. Criticism of Nativistic Theories.
    (a) The general form of Nativism
    (b) The special forms of Nativism

2. Criticism of Empirical Theories.
    (a) The general form of Empiricism.
    (b) The special forms of Empiricism.

2nd Investigation of Facts and Special Questions.

1. Binocular vision and its relation to the problem.
2. Illusions and their relation to the problem.
3. Experiments and experimental cases in the problem.
    (a) Native powers of sight and touch in the idea of space.
    (b) Conditions of a common sensible.

I

Criticism of Theories.

1. Objections to Nativism in General: or Facts adverse to Nativism in any Form.

The first objection to any form of nativism is from Helmholtz*. It is that it cuts off all further inquiry regarding the notion of space by making it an original and innate product of the mind and incapable of further explanation. The appeal to intuition has often been made in order to shut off discussion in other questions and hence if we are obliged to regard the notion of space as apriori we must stop the consideration of all the facts and difficulties that seem to cast doubt upon this supposition.

It will be seen upon reflection however that the objection entirely misses its mark. No doubt the appeal to apriori principles has often been the resort to stop discussion, but that fact is no proof that

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* Popular Scientific Lectures First Series, p. 240. (Translation)

it is so in this case. Besides it may be true enough that it shuts off all further inquiry; but it does so only to the person who reaches the conclusion that the thing is true, and not to the person whose mind is not decided upon the question. Even if it be an intuitive idea, our belief that it is so may be long subsequent to the time of its origin in consciousness and no mind is prohibited from inquiry as to whether it is apriori or not until it has once studied and decided it. This is the case with all ideas, whether native or empirical. After we once decide they are true we stop inquiring whether they are true or not: even if we suppose them empirical. Helmholtz does not distinguish between an intuitive idea and a theory of it. The fact that an idea is intuitive does not shut off inquiry about the truth of a theory affirming this fact. The theory that it is so does not prohibit investigation and inquiry regarding itself, until its truth is demonstrated, and then like all proved theories its acceptance renders inquiry to prove it

unnecessary. Investigation may be carried on in elucidation and confirmation; but not to prove a doubtful proposition. Hence investigation is not more retarded by nativism upon the acceptance of it than by empiricism. If the idea of space originated from experience the acceptance of that fact would as much shut off inquiry as any theory of nativism. The objection therefore proves too much. And besides the objection can have no special force coming from the school of Helmholtz, because it could be made with equal force against every form of native conditions, and Helmholtz accepts the a priori and native character of the idea of cause.* If the mere fact that nativism shuts off inquiry is the proof of empiricism in regard to space it would do so in regard to causality.

This objection and the reply to it is important for bringing out the distinction between a fact and a theory about it; between the fact that the notions

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* Die Thatsachen in der Wahrnehmung. s. [illegible].

of space is native, and the theory with its proof that such is the fact. Many of the details and counter-supports of a theory may be false, while the main fact which it wishes to substantiate may remain true and unshaken by the disproof of supplementary incidents. Hence empiricists must remember that the supposition of nativism does not shut off inquiry until it has been proved or disproved: their business is to answer it, not to complain of consequences if it be proved true. Besides the objection would recoil upon empiricism for making experience an ultimate fact which it does. Empiricism is just as dogmatic about experience as nativism can be about ultimate ideas.

The second general objection to nativism takes the form of a presumption. Many facts and ideas have been shown to be the result of experience which were supposed to be innate. The question then arises, why may not all such ideas be derived? If nativism be invalid unless in some cases why may not further inquiry

prove it entirely so? The numerous theories seems in favor of empiricism.

We are not concerned, at least at present, in answering this objection: we admit at once that many assertions of intuitive theories that were made to support the whole scheme have been analyzed and disproven upon further investigation from experience. It is a fact that deserves respectful consideration and advises caution about too great confidence either in assertion or in the formation of an opinion in that direction.

There is a third objection to nativism which asserts that the theory is in contradiction with facts, and is unable to explain the illusions of the various senses. If the notion of space is innate and apriori, then as this objection implies, no illusions regarding it would take place, because by supposition it is neither furnished by experience nor modifiable by it; it must be immediate and unalterable from the first. But such a supposition empiricism theories is shattered by illusions which show that perpetual errors are made in judgments of space.

If these objections require refutation it must be accomplished by an analysis of the problem which we can not give at this stage of the discussion: but they will be considered in the conclusion. We have to see the objections to special forms of the theory in order to understand what is required of a satisfactory solution of the question. Hence the second division of the criticism.

2nd Objections to special Forms of Nativism.

We take first the theory that the notion of space is native to the sense of touch, whether it be regarded as a common sensible or not. It may be claimed that the idea of space is original to touch only, or that it is common to tactual, muscular and visual sensations. But in whatever form its nativity to touch is conceived its relation to the present objections will not be altered. What is wanted, then, to show, that space is not a native perception of touch is proof that tactual sensations can take place without the notion of space coming into existence, or long before that notion becomes associated with them. This we wish to show.

conforms precisely with the postulate of empiricism. That an idea to be experiential or acquired must be the subsequent result of phenomena which can exist independently of it. The native functions therefore of any sense will be those states of consciousness which cannot be removed or kept out of existence when that sense is in its normal activity. If, therefore, we can find sensations of touch unconnected with the judgment or consciousness of extension, the implication is that the idea of space is not a necessary element in its deliverances.

First, if we thrust a pin or a needle into the flesh there is a sensation of pain, but none of extension, unless we include in the total state of consciousness the localization of the sensation in a particular part of the body or sensorium. But aside from this the pain itself will not, most probably, be judged as distributed over any, even the smallest, amount of space. Yet there will be a distinct perception of resistance, varying in intensity and character with the nature, place and circumstances of the stimulus. In this case certainly

a tactual sensation takes place without out giving any notion of its extension or the object causing it, or any notion whatever of the amount of surface affected on the sensorium. So far as consciousness is concerned it is a merely non-extended area, and constitutes a phenomenon in that respect no way different from an internal state. If the notion of space arise at all in connection with the sensation it will, as said, be the localization of it in some portion of the sensorium. This localization of course assumes the idea of space to begin with, or the power to determine relative positions in space. If this were thus a native in such cases the experiment is futile for such purposes as it was intended to serve: because it includes the idea of space whether consciousness is able to distinguish extension in the stimulus and in the local area affected, or not.

But there are facts whose interpretation seem most favorable to the view that localization is acquired. If so, it would appear that the notion of space is not a necessary constituent of tactual sensations.

"The young child cries when it is in pain, but does not show by any sign that it refers the pain to a particular spot. When we awake with a feeling of uneasiness and discomfort we cannot give it immediately a precise local origin" * Platner's case reported by Hamilton evinces a similar phenomenon. His experiments performed upon a person born blind convinced him "that the sense of touch, by itself, is altogether incompetent to afford us the representation of extension and space, and is not even cognizant of local exteriority (örtliches Auseinandersein), in a word, that a man deprived of sight has absolutely no perception of an outer world, beyond the existence of something effective different from his own feelings of passivity, and in general only of numerical diversity. In fact to those born blind, time serves instead of space. Vicinity and distance mean in their mouths nothing more than the shorter or longer time, the smaller or greater number of feelings, which

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* Ribot. German Psychology of To-day p. 113. Translation

Mr. Editor.

The trouble with Mr. Henry Finck's writing is that he can never resist the temptation to be witty and humorous. This may be very well in literature but in scientific discussion it spoils both his science and his wit, because you can never tell whether he is in fun or in earnest. The suspicion of doubt colors even his facts.

the time necessary to attain from some one feeling to another'.* Hamilton's own observations are affirmed to confirm this view, and he thinks the Cheselden case does the same thing. Another case reported by Hamilton** and quoted against him by J. S. Mill*** illustrates a case where a patient lost the power of localizing tactual sensations, although as acutely alive as ever to their existence. As he recovered, the power of localization was restored. Another author reports as follows: "There are many persons — I am acquainted with some — who will make an error of a yard in four or five in comparing distances so walked with the familiar visual judgment of them; who nevertheless are remarkable for accuracy in judging of distance and magnitude by the eye. Whenever angles have to be measured as well as intervals the difference is still more striking"****.

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* Hamilton. Lectures on Metaphysics p. 389 f. Am. Ed.

** Hamilton's Edition of Reid's Works. Vol. II. p. 874.

*** Mill's Examination of Hamilton. Vol I, p. 312. Am. Ed.

**** Abbott. Sight and Touch. p. [illegible]

in strong confirmation of these facts in the experiments of Weber and others regarding the localization of tactual sensations and the perception of two separate sensations of the same kind at the same time. These experiments prove that two separate and distinct portions of the sensorium can be affected at the same time and yet the sensation seem single: only after a certain variable limit has been reached will a perception of space or coexistence arise, and this may be due to a qualitative difference between the two sensations. But at any rate, the sensorium may be affected at two or more distinct points and no perception of space occur in connection with it, although the sense of excitation is especially keen. The following table shows the distances in millimeters

Tip of the tongue	1.1
Palm of the last phalanx of the finger	2.2
Palm of the second " " " "	4.4
Tip of the nose	6.6
White part of the lips	8.8
Back of the second phalanx of the finger	11.1

Skin over the malar bone	15.4
Back of the hand	29.8
Forearm	39.6
Sternum	44.[illegible]
Back	66.[illegible] *

The importance of these experiments from Weber is that they are not isolated cases such as those of patients who have been operated upon; but are cases representing a general law of the tactual sensorium and hence confirm the conclusions presumed from less satisfactory instances. All of them, however, furnish the requisite facts for an empirical theory of tactual space: they go to show that sensations of touch may be unaccompanied by the sensation of space, even after it has long been associated with tactual sensations.

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* Foster. Physiology. p. 578.
Wundt: Physiologische Psychologie. Vol. II, p. 7.
Bain. Senses and Intellect. p. 175
Abbott. Sight and Touch. p. 3

The plain inference from them is that the notion of space is not necessarily a constituent of tactual sensations and hence becomes connected with it by experience. The facts are very strong ones, to say the least of them, and would certainly lead to the modification of nativistic views, if they are to be retained at all. But we are not concerned in an analysis nor in a refutation of them. We wish only to see either the weaknesses of nativism or the facts which it must explain if it is to survive the trial of investigation and criticism.

We take up next the objections and facts which militate against the theory of nativism in the sense of vision. Helmholtz sums up his objections to it in the three following passages:—*

1st "Nativism introduces an unnecessary hypothesis."

2nd "Its results give conclusions that rarely accord with facts when accounting for ideas of space. Its advocates are obliged to admit against themselves that their

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*Helmholtz, Physiologische Optik p. [illegible] 867.

original sensations of space may be modified, or, indeed, replaced by knowledge furnished in experience."

3rd "It is difficult to see how the supposition of original sensations of space can contribute anything to the explanation of visual perception since the advocates of nativism are compelled to admit that in the great majority of cases these sensations must be supplemented by very profound experiential knowledge. If this is necessary, it seems simpler and easier to admit that all notions of space are furnished by experience only, without having first to combat innate notions which are false in most cases."

There are facts also which are employed to disprove the nativistic theory.

1st The inversion of the retinal image.*

It is known that the image on the retina is inverted as compared with the position of the object seen: hence it is inferred that if nativism be true, the object would seem to occupy the same inverted position that the image has upon the retina.

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* Helmholtz. Popular scientific Lectures p. 242 Translation
[illegible]

2nd The occasional fusion of images at disparate points, and double images at identical or corresponding points. It is the claim of nativism that objects must be seen single at identical or corresponding points, and that double images will not fuse at disparate points upon the retina. But experiments of Helmholtz prove the reverse of this claim.*

3rd A third difficulty is proposed in the fact that we see single although there are two images upon the retina.** Nativism would suppose vision according to the actual impressions upon the consciousness; but in the case of two impressions experience actually overcomes and corrects what would be the natural tendency of nativism.

4th The fourth difficulty of nativism is the constant illusions that occur in vision, both in respect to the magnitude and the distance of objects. This fact concerns all three forms of dimension; but it is most conspicuous in the case of the third dimension or solidity. We constantly mistake the [illegible]

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* Helmholtz. Physiologische Optik pp. 728 – 741. 1867.

** Helmholtz. Popular Scientific Lectures p. 293. [illegible]

the size and the distance of objects in the field of vision, which ought not to be the case if space were a native perception. Actual cases of such illusion will be seen in the following facts and references.* Such facts as the different apparent magnitudes of the moon at different seasons at the same time or at the same season at different times and when it changes its position in the heavens, or the different apparent distances of mountains as seen by travelers in all parts of the world and more especially in Switzerland, point to variations of judgment as to

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* Fraser's Selections from Berkeley pp. 169 – 183
" Le Conte. Sight. pp. 156 – 164. Inter. Scien. Series.
" Porter. Human Intellect pp. 61 – 106.
" Helmholtz. Physiologische Optik. p. 622 – 664. Especially 623 – 633
" Lotze. Medicinische Psychologie pp. 435 – 453 802
" Stumpf. Ursprung der Raumvorstellung. p. 162.
" Bain. Senses and Intellect p. 236 – [illegible]
" Sully. Illusions. Part I. chs. V and VI.

size and distance, that are consistent only with the criterion of experience. Large quantities of illusions are thus unaccounted for by nativism. If we take two cards, say a foot long, placing one of them upon a level and the other upon an inclined plane extending in the same general direction as the one upon a level, and put two pins upon nearly the same line horizontal to vision, or vertical to the line of direction, but a slight distance apart, and then look at them with one eye at some distance from them and from a position from which we can look upon the two cards or planes at an inclined line, the pin in the card which is inclined and slopes upward will appear ~~nearer~~ farther off to the observer; and it will even appear so when the other pin is placed at some distance back of it, showing that there is an illusion of space when certain relative positions in lines and points are impressed upon the retina. The figures which produce the illusion of the third dimension illustrate the same phenomenon. They show the perception of space where there is none actually represented upon the retina. Hence

lusions can be best accounted for by supposing that they are due rather to associations from experience than from the exercise of native functions in circumstances which do not call for their operation.

The cases of the blind from birth who have been operated upon for cataract show very great inability to judge of either magnitude or distance. Some of them thought the objects touched the eyes, or were very near, and some thought an object seen by both eyes twice as large as when seen by one eye. The most celebrated cases, those of Cheselden, Platner, Wardrop, and Franz, all agree in this phenomenon.* Dr. Carpenter reports additional cases which show the same fact.**

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* Hamilton. Lectures on Metaphysics pp. 389-393.
" Helmholtz. Physiologische Optik. pp. 587-593, 807.
" Sully. Psychology. p. 694.
" Wundt. Physiologische Psychologie vol. II. p. 78
" J. S. Mill. Exam. of Hamilton's Philos. Vol I pp. 284-301.
" Stumpf. Ursprung der Raumvorstellung pp. 289-294.
** Carpenter. Mental Physiology pp. 180-204. 4th edition.

These facts with many various experiments which might be mentioned, and the phenomena of inaccurate determination of distance by newly born infants are uniformly urged as fatal to nativism in the province of vision, whether it can be assumed in touch or not. They do point to serious, if not conclusive, difficulties, because certain quantities of extension are either not represented in perception as they are, or they appear in perception when there is no corresponding extension in the stimulating cause. The illusions of muscular perspective illustrate this. A perception which would be the product of a natural and innate capacity should show no such variations, contradictions and illusions. Hence the inevitable inference is that such consequences must show the idea of space to be experiential, or at least that nativistic theories break down in the consideration of the facts and experiments referred to. But without providing an answer to the arguments indicated, it is enough to know the strongest against nativism upon taking up the consideration of empiricism.

3rd Objections to Empiricism in general: – Facts that oppose Empiricism in any form.

The first general objection to the theory of empiricism regarding the notion of space is the fact that the motives which originated it in modern times are entirely aside from the real question at issue and have tended to confuse two distinct problems.* Nobody, not even Locke and his school, seems to have questioned the native and original character of the notion of space, until the exigencies of a realistic philosophy required opposition to idealism which was ostensibly founded upon certain conceptions of time and space. Mistaking the view that the apriori implied the subjective and ideal nature of space, and desirous of refuting Kantian idealism, empiricism supposed that there was no resource, but to transfer the notion of space to that class of phenomena recognized as empirical and acquired, and having thus supplanted the apriori by an empirical conception of it, it supposed that the refutation of

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* Helmholtz. Pop. Lectures p. 226

its subjective nature would follow as a matter of course. But the two facts are entirely unrelated in the Kantian system: the idea of space was not regarded as ideal because it was apriori; but for entirely different reasons. Its apriori and subjective qualities were merely coincident characteristics, as is shown in the fact that the same philosophy held the 'secondary qualities' of matter, color, sound, weight, flavor, savor &c. to be subjective, and also empirical at the same time. Kant's denomination of the idea of space as apriori referred to its origin and meant that it was original and could not be deduced from something which contained or implied none of it. Hence it characterized the problem of its genesis, while his conception of it as subjective or ideal referred to its nature whatever might be its origin whether apriori or empirical.

Empiricism has for its proper problem the genesis of the idea of space and not its nature, and the reason for this is found in the fact that the proper

antithesis to it is nativism, and neither realism nor idealism. Ribot, an empiricist, admits this. In concluding a chapter upon the two theories of space, he says: "We will add, in closing, that it would be wrong to attribute to either of the two schools an invariable philosophic tendency. In fact nativism is as likely to be materialistic as idealistic. In the former case, the innate idea of space is referred to the anatomical constitution of the organs only; in the latter, the idea of space is considered innate in consciousness".* And again: "It is evident also that Kant's doctrine of space and the theories we have discussed deal with problems of an entirely different order. Whether we consider space an *apriori* form of mind or an objective reality, or an abstraction the question of its genesis in the human mind remains unanswered".* Nearly all speculations in the scientific investigations since Johannes Müller have been regarding either the physiological or psychological *genesis* of the idea

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* Ribot. German Psychology of To-day p. 133 (Translation).

of space, although insufficient to convert nativistic theories to assuming its empirical origin. As we have sufficiently indicated the proper problem of empiricism is the genesis of the notion and not its nature. Hence if any further limitations and objections are to be valid against it as a general theory they must be presented against either its contradictions in other respects, or its conception of the problem.

The second general objection to empiricism is that it undertakes the deduction of the idea of space from non-spatial data while maintaining an irreconcilable opposition to transcendentalism. We grant that it is a legitimate effort to seek the origin of the idea in data not supposed to contain a [illegible] any of it, if we insist that such is what must be done in order to satisfy the requirements of a scientific theory. But we have to subject such efforts to two tests. First, whether the antecedent phenomenon to which the idea is traced contains any space. If so, then the requirements of its own postulate

have not been fulfilled. And second, whether the implications of transcendentalism which are involved at least in some general forms of empiricism are admitted or denied. If transcendentalism which is involved in the supposition that the idea of space is a purely contingent and adventitious product of experience, is denied, then there is a contradiction between the terms of the theory and the implication involved in them. As to the first of these tests we are not concerned in examining whether empiricism will stand it or not; at least at present. Whether it is actually successful, or not, in tracing the idea to non-spatial elements in consciousness is no objection to theoretical or formal empiricism; but only to the actual efforts made, not the method. But if its method implies either the reality or the possibility of a transcendental metaphysics which it denies, one or the other of these two factors must be given up. That it does imply such a system, we think can be made evident. In the first place the empiricist in endeavouring to trace the development

and view of the idea from non-spatial phenomena implies and asserts as we have shown that these phenomena can exist in consciousness without necessarily calling the conception of space into existence: and inasmuch as it refuses to recognize a native form of it in any of the senses, it assumes that the whole conscious life is something necessarily unrelated to space or perhaps better, that it may exist without space or its idea. All our sensations therefore are neither necessarily spatial, nor necessarily connected with space or the idea of it: so that the latter is entirely separable from the former and sustains merely a contingent relation to it. Singularly enough this is merely the position taken by thorough going Kantians in order to prove both the a priori and subjective nature of space.* They would not regard it as contingently connected with it, but as something which requires an agency distinct from mere sensations in order to produce it.

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* Bowne, Studies in Metaphysics. pp. 434 and 447.
Lotze. Microcosmus Vol I. pp. 492-493.

thus make the position of empiricism the contradiction of idealism, which empiricism has been in such haste to condemn. This is not to say that we adopt it; but it is well to know how easily the assumption plays into the position which empiricism set out to avoid.

A third objection to empiricism in general is the fact that it scarcely ever, if at all, employs experience in the same sense. It is now used in one sense and then when the exigencies of the argument require the same word to be employed, in order to conform at least apparently to the shibboleth of the school, it uses it in another and very different sense, with very different implications. At one time experience means simple sensations or realized states of consciousness excluding from their content every element of space, and at other times it denotes the repetition of the same or similar states with the supplementary increments of time and exercise. In one it is isolated and unconnected phenomena; and in the other it is a complexus of mental states re-

inforced by repetition and the accessions of farther perception. Two more different meanings could hardly be conceived. In illustration of this we take a passage from Helmholtz. Speaking of the relation between the external and internal world, he says:

"The correspondence, therefore, between the external world and the perceptions of sight rests, either in whole or in part, upon the same foundation as all our knowledge — on *experience*, and on constant *verification* of its accuracy by experiments which we perform with every movement of our body." * The italics are his, and suggest an analysis of the implications in the terms so italicized. In the main work by the same author "experience" is generally, if not uniformly used to denote exercise and repeated impressions with their cumulative results.**

But it is the implication in the first case we wish to discuss, and without any reference to a criticism of

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* Helmholtz Popular Scientific Lectures. p. 270. Translation

** Helmholtz, Physiologische Optik pp. 431. 432. 437. 1867.

Helmholtz's position generally; but only to what is generally implied by this way of speaking which is common to others with the author quoted. We have taken an actual case in order to avoid the suspicion of misrepresentation.

The statement that our knowledge depends upon "experience" and its "verification", implies that experience is not adequate to the whole result, but requires verification: and the way that the verification is accomplished shows that this verification is "experience" in the second sense in which we have defined it. So that the only recourse is to identify "experience", as he has used it, with simple sensation. It seems strange that we are asked to adopt the empirical theory of the origin of space ideas, and then told that it had to be "verified before we accept it. To assume or to assert that experience needs verification is to surrender its efficiency to account for the idea of space, and to grant precisely the claim of the nativist. For, what is to verify experience? It cannot be experience, be-

cause this must in turn be verified, and so on _ad infinitum_, which is a failure to reach any conclusion. Hence it must be something more valid than experience, according to the terms of the statement. What that is we are not told, but it must be _extra-experiential_, taking that term as there used.

But without supposing any antithesis between experience and its verification, we must regard the former either as simple sensation, or as a complexus of repeated states with their result. If Helmholtz mean the former and also that the notion of space is derived directly from it, he is at one with the nativists, as the following passage indicates. "It is often very difficult to decide what is immediately obtained or conditioned by sensation in connection with perception, and what is conditioned by experience and practice".* In this sensation is admitted to be immediate and ultimate, so that the supposition

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* Helmholtz. Physiologische Optik p. 435. 1867.

of experience in the former passage being a sensation would make the idea of space as ultimate as its source. But if it be taken the sense used in the last passage and denoting verified results or processes of repeated impressions, the question arises, what power can be added to a sensation by repetition, unless there be tendencies in the mind or organism to produce something from it. The idea of space either belongs to the simple sensation to be repeated, or it does not. If it belong to it it is native as the sensation itself: if it does not belong to it by nature the repetition of the sensation will never discover in it what is not there; so that the supposition that the idea of space is the result of verification of experiment admits either that it is in the original data, and, although latent to speculative consciousness, is still native to the content of sensation, or that it is a mental addition to experience, which is again precisely the Kantian doctrine that empiricism set out to refute.

Besides in what sense of the term that is

an ambiguity which does not satisfy the requirements a complete theory. In the first sense, it denotes any state of conviction whatever and may be the source of all kinds of error and contradictions; and thus we should never know whether the idea of space was valid, or not. In the second sense, the term is exposed to a like difficulty by the confession of its need of verification, and the fact that we can never tell exactly what mental states constitute an "experience" until they are thus verified. It must be either the simple sensation that has to be verified, in which case the experience as a simple sensation, does not guarantee the idea of space; or it must be the complex and repeated mental state that needs verification, in which case there is also no guarantee for the idea outside the verification of experience and no criterion imposed by which the verification can take place. The need of verification in any case implies that there may be error in that which has to be confirmed; and hence far from experience being the guarantee for the idea, that factor

has to have its deliverances proved. Such an admission is a concession that experience may also be the source of error, and hence may not contain the notion of space at all in its real content. If it ever appear in connection with it, the fact that it originates from it has to be confirmed according to the above supposition, before it can be accepted as having such a genesis. Besides experience is always assumed to represent each step of the antecedent process, and if it contains no element of the notion of space until it is verified, or cannot be accepted as evidential until so confirmed, it is certainly a very strange source by which to combat the position of nativism. This fact of its ambiguity is evidenced by the constant appeal to it in order to show the fluctuations supposed to prove fatal to nativistic theories. Experience has 'no certain sound' and hence it is calculated to excite controversy.+

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* Bowne. Studies in Metaphysics. p. 59.
Mill's. System of Logic. pp. 537-547.

4th Objections to Special Theories of Empiricism: or Facts and Reasons which render certain Empirical Theories unsuccessful in their application.

It is in this part of the discussion that mediation and conciliation between nativism and empiricism will be implied, although its distinct purpose is to show the failure of certain empirical theories to obtain results conforming to the postulates and assumptions made by them. Still the proof of such a failure is no proof of nativism, but it does prepare the way for the analysis which indicates that the two theories may run parallel with each other upon separate issues.

We shall first take up Wundt's theory and ascertain whether he actually accomplishes what he sets out to accomplish. He admits and his whole discussion implies that the idea of space must be developed from elements containing none of it, if empiricism is to be justified in making the notion experiential.*

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* Wundt: Physiologische Psychologie. Vol II p. 27-28 & [illegible]
Wundt: Human Psychology & [illegible], pp. 22 & [illegible].

Hence he proposes what he calls the synthetic theory of the origin of space conceptions. The notion he regards as a synthesis of elements containing none of it, and may be as different from its constituents as water is from oxygen and hydrogen. The elements composing the idea of space he regards as "peripheral sensations" (peripherische Sinnesempfindungen) and "central innervation sensations" (centrale Innervationsempfindungen). These of themselves are supposed to be states of consciousness which contain no inherent element of space, but are connected by an act of synthesis to produce that idea. The theory seems to have been suggested by that of J. S. Mill who spoke of the act as resembling a chemical combination, but did not it so elaborate and scientific an expression as Wundt.

In the examination of Wundt's synthetic theory the first object will not be so much to disprove the theory as to examine whether it accomplishes the purpose claimed for it: whether synthesis is what he claims it to be. Hence there must be [illegible]

distinct questions to answer in reference to his view.

1st The question whether he is a consistent empiricist, or not.

2nd The question whether the elements of which the space idea is supposed to be compounded are really non-spatial data.

The further question of other difficulties in his theory will be considered afterward. But first as to his empiricism.

That Wundt wishes to be regarded as an empiricist in reference to the origin of the idea of space is evident from the following references in which he is always careful to criticise the nativistic hypothesis, although admitting some aspects of it.* In one passage he nearly affirms his empirical position. In discussing the relation of his synthetic theory to the Kantian view of the subjectivity of space, he says: "Objective reality outside of consciousness can-

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* Wundt. Physiologische Psychologie Vol II pp. 23. 31–34. 167–179

. Wundt. Logik. Vol I pp 452–461. Especially p. 460.

not belong to space in the form in which we perceive it." Yea more this conclusion follows from the position just attained of the synthetic theory more evidently than from the nativistic theory of Kant."* Besides he states his own view under the classification of the genetic theories as opposed to the nativistic theories.** We should suppose at once that he meant by this position what all empiricists mean by it; namely, that the idea of space is a product of experience. But in three distinct places he positively affirms it to be, as Kant affirmed it, the antecedent condition of experience, and he states it so as to make it both logically and historically the a priori condition of experience.*** The first is: "Denn Erfahrung und Uebung können erst ihre Hebel ansetzen, wenn eine

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* Wundt: Logik Vol I p. 460

** Wundt: Logik Vol I pp. 455 – 456.

*** Wundt: Physiologische Psychologie Vol II p. 23

" Wundt: Logik Vol I pp. 455 and 46

räumliche Vorstellung schon gegeben ist." The other passages are as definite as this, and they show that the conception of "experience" is taken in the Kantian sense to denote a complex state, or the result of repetition and exercise, and not in the Lockian sense to denote a simple isolated sensation. But they show conclusively that he does not regard the idea of space as the product of experience, but its condition. He can, therefore, save his empiricism only by changing his conception of experience which he nowhere does, although his theory in other aspects of it may imply that change. But so far as he has positively defined experience, his desire and effort to favor empiricism are in express contradiction with it. Besides positive statements will be found in all the references made that will show such an adoption of nativistic views as prove either a contradiction on his part, or the possible reconciliation and coexistence of both theories. However that may be, he cannot be an empiricist from his own definitions and statements.

whether he is an empiricist in the Lockean sense of the term "experience" as applied to the constituent elements in the idea of space, he nowhere indicates; as he does not say whether the tendency to form this synthesis is native or empirical. He would have to take sides on this question before he could at all be classified. If the act of synthesis be a native one, the notion of space arises in the first instance that a peripheral sensation and central innervation sensation occur in the same moment; and there is no opportunity for a mental life in a period of time independent of space. But if it is a tendency developed by experience; that is, after the repetition of those mental states constituting the elements of the notion, then the mind's life is not necessarily limited to space, but sensations are fundamentally and essentially unrelated to space, so that the notion of space is both an adventitious product of time and development, and a subjective quality of consciousness as chosen. But Wundt does not tell us whether this synthesis is

native or experiential. Since we are left to suppose that it is consistent with either assumption; at least until we examine the second question, which concerns the success of his effort to develop the idea of space from non-spatial data.

Wundt's chief merit is that he sees clearly the necessity of originating the conception of space from data not containing it, and that he makes a vigorous effort to accomplish such an end. The main point that he makes against the hypotheses of Lotze and of Helmholtz is that their data contain the very conception they endeavor to account for.* The objection, however, does not tell against Lotze, because he is a nativist by express confession, although it may have force against Helmholtz, because he endeavors to support empiricism. How does his own synthetic theory stand this test? There are two considerations to be taken into account when answering this question. They are:

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* Wundt. Physiologische Psychologie Vol II p. 177

1st The exact conception of the elements entering into the synthesis.

2nd The nature and results of the synthesis with its relation to the two theories, nativism and empiricism.

In the first of these cases, the question is whether the elements of the supposed syntheses contain or imply a notion of space previous to the process of combination. The two elements are spoken of as "peripheral" and "central", and in such conceptions the idea of space is already contained, and if they are supposed to be known to consciousness as peripheral and central previous to the synthesis, they contain the space idea and the result of the synthesis exhibits nothing more than what was contained in the elements and the theory breaks down upon its own reasoning. But it must be admitted that it is intended that the mind is not supposed to be conscious of the sensations as "peripheral" or "central", but only as qualitatively different states of consciousness. The first (peripherische Sinnesempfindungen) are supposed

to be unlocalized, and as such mere mental states unaccompanied by a notion of space. The evidence for such a supposition may be found in Weber's experiments on the localization of two or more distinct impressions at the same time, in some pathological cases showing an inability to localize or determine the spacial relations of sensations, and in cases where infants seem to indicate no localization of pains. Two of these facts however, are of no force. The first has two limitations imposed upon its universality which would have to be the case to separate sensation and its localization completely. These are the fact that the sensations are already known as peripheral in the experiments, and the fact that there is a limit to the area over which two or more impressions are perceived as one. In the case of infants there is absolutely no proof that they do not localize sensations and pains. In adult and mature experience the proof of localization is their not having the sensation in their consciousness is

or consists of certain movements to indicate or to prevent the sensation of a pain. This always requires the adjustment of means to end, or the coordination of various sensations and movements to a given purpose. The infant may not have learned the connection between these phenomena, although the locality of the sensation may be as clearly defined in its own consciousness as in that of a mature mind. The only possible proof of its non-localization would be the express statement of the infant and that is manifestly out of the question: and inferences to it are liable to mistake from the fact that they must assume a natural connection between the consciousness of locality, and the voluntary movements which would indicate it, or which are employed to continue or remove the sensation. As a matter of fact these may be entirely separate. The pathological cases are cases in point*: but these are abnormal and

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* Wundt: Phys. Psych. Vol. II p. 4., Beiträge zur Sinneswahrnehmung, p. 47.
" J. S. Mill Exam. of Hamilton Vol. I. p. 302. (Am. Ed.)

require great caution in making the results of observations true for the normal sensorium. It may even be question whether any inference from abnormal to normal sensoria can be possible. But we shall admit the assumption that sensations due to causes extra-mental may be non-localized, or unaccompanied with the consciousness of space relations, and see whether this can be true of "innervation sensations" (Innervationsempfindungen).

The denomination of these sensations as "innervation sensations" decides, very plausibly at least, the space idea to which they contribute. If we can succeed, therefore, in keeping them merely qualitatively different from the "peripheral" sensations just discussed the general case will be very well made out. But notwithstanding their name, they are reckoned by Wundt as *motor* sensations. The fact that they have a "central" origin is an immaterial matter for the purpose of the theory; the main characteristic is that they are *motor sensations* (Bewegungsempfindungen)

The fact that Wundt so regards them can be shown by references. Speaking of the way that those born blind obtain a notion of space, he says: "The single means which they possess for forming the notion of space rests in the sensations of pressure upon the skin and motor sensations in the limbs".* And again alluding to attempts to reduce motor sensations to one of three causes, he recognizes all three elements as capable of producing them, but they must act together and are not in any experience found separate from each other. They are tactual, muscular, and conative sensations (Innervationsempfindungen).** These 'innervation' or conative sensations apply to the muscles of the eye as well as to other members of the organization. Under certain abnormal or artificial circumstances tactual and muscular sensations can be eliminated and we may have only the conative present in consciousness, and they

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* Wundt: Vorlesungen über Menschen- und Thierseele Vol I p. 260. Also 248-9.

** Wundt: Phys. Psy. Vol I pp. 372. 374. 376. 377. Vol. II. p. 27

constitute the original conditions of all motions. But so far as innervation sensations are motor sensations they contain the idea of space and thus one, if not both of the elements in the synthesis contain the phenomenon to be explained. If we are ever conscious of motor sensations as such we are conscious of a factor which implies space, while the theory requires that space shall not be involved in its conditions. But the very condition of motion is space, and the sensation of motion implies that the element of space is included by the very fact that the phenomenon of sensation is recognized as motor. Hence if 'innervation' sensations are identical with conscious motor sensations, the synthetic theory breaks down at once, according to its own postulates that the elements composing the idea of space shall contain none of it.

But in justice to Wundt's intention, we cannot identify motor with conative sensations, although the former may be regarded as the resultant of the latter. When the author speaks of motor sensations (Bewegungsempfin-

sensory), Wundt requires us to assume that he means those sensations which are afterward in our experience connected with motion and motor sensations, and hence innervation sensations import as he defines them mere sensations of effort, or resistance to exertion. They are noticeable in the occasions of thwarted action when no motion takes place or is perceived. He calls them Kraftempfindungen, or Bewegungsimpulse, by which he excludes the consciousness of motion, and includes only the consciousness of exertion, or those sensations which are distinguished from others by the peculiarity expressed in the expenditure of force. By this act spacial relations are abstracted, or thought away. We have then, notwithstanding the associations implied by the language used, the supposition, supported by experiment and observation, that the two classes of sensation, called peripheral and central by way of distinction, do not necessarily involve the notion of space. They are supposed to take place in consciousness without being necessarily connected with that idea. Hence by

the terms of the theory their synthesis produces that idea; but the same theory requires as its postulate that we exclude from those elements any content of the product to be derived; so that we can think of the sensations *only as qualitatively different*. We are not allowed to characterize that difference, as peripheral, central, or motor, as all these imply space; and hence we can only suppose the consciousness of a difference in kind. We cannot suppose the difference to be one of intensity, as this applies to sensations of the same kind, and the theory we are examining requires elements differing in quality not in quantity. Hence the position has at least a formal consistency that will be hard to analyze and answer.

But if the theory cannot be accused of a contradiction there may be an examination of it that will exclude it from empiricism, on the one hand; and exhibit its gratuitous assumptions on the other. For, it is not necessary that we should reduce a view to a contradiction in order to refute it, or to show it

to be unsatisfactory, although that is the easiest and most decisive method of making our experience clear. It is possible in some cases to show that there are other alternatives for assumption just as possible in the terms of the problem as those chosen. Since a satisfactory reason must be shown for choosing given assumptions in preference to others whose qualities come within the requirements of the questions. By this we mean to call attention to the facts that the only difference between the elements composing the idea of space is that of quality; but that quality is not specified in any terms that require the exclusion of other sensations just as different in kind, but not admitted in the synthesis. The theory requires only that a synthesis of *qualitatively* different sensations take place in order to produce the idea of space; but chooses the innervation or conative, and the stimulated sensations, extra to the sensations of the subject to satisfy the terms of the problem. Now in as much as we can only say that

These sensations differ in kind, the question arises why not assume a synthesis of any other sensations which display qualitative differences. We find as great qualitative differences between the several sensations regarded as peripheral, as between these and the conative. There is as great a qualitative difference between smell and touch, or hearing and vision, or taste and temperature, as between any of these and those of exertion. Hence, in as much as we cannot distinguish the one as peripheral and the other as motor from the outset, they are all brought together as states of consciousness, not involving space relations, but only a difference in kind. There is no reason, therefore, aside from the implications of space and the exigencies of the problem, for choosing one difference in kind from another. Why not then suppose the idea of space produced by a synthesis of the sensations of smell and temperature, of muscular and tactual sensations, or of the tooth ache and stomach ache? Why not suppose a synthesis of the sensations of light

and of inhalation? The difference in kind is as great here as elsewhere. And the case might be carried farther, since the exclusion of all spacial elements from the several experiences of the mind in no way distinguishes them from states of consciousness which never contain a notion of space, such intellectual pleasure, surprise, memory, judgment, reasoning &c. Why should not a synthesis of these states with some others produce the idea of space, especially as they contain all the essential differences in quality which are required for the case?

These questions bring us to a very important issue in the problem; and it is that the sensations chosen for the synthesis have a very strong suspicion of having been chosen because of their affinity with the idea of space, especially the conative sensations. Hence, although great caution is displayed in using some to exclude the notion of space, it seems that there is as much caution shown in the choice of elements, so that at least one of them shall have the requisite possibilities contained in it. Besides

There is a tendency to connect the idea of space so closely with voluntary states of innervation which are included in the formula of Wundt's theory. It may be a question whether we are ever conscious of 'conative' states, or sensations of exertion, except in cases where voluntary effort is impeded by resistance foreign to control, and impeded in such a way that no consciousness of motion accompanies the feeling of exertion. If this be the case, no conative sensations can ever be separated from those of motion in the reflex states: the inhibited motion, therefore, in the case of resisted voluntary innervation is the only case where conative sensations can appear in consciousness apart from the sensations of motion. Sensations of innervation are therefore the regular concomitant of motor sensations, and the innervation impulse the cause of the motion. We must distinguish here between innervation and the consciousness of it. It is the consciousness of it that concerns us in discussing the merits of the synthetic theory which endeavours to explain the notions of space [illegible]. The

phenomena of consciousness. If it refer the notion to the acts of innervation itself, as it is either a physiological process, or a psychical process below consciousness, it at once abandons the problem as it must be discussed between nativism and empiricism: because experiential theories regard experience as a state of consciousness, or the repetition of such states with comparisons and accumulation. To resort, therefore, to unconscious phenomena, whether physiological or psychological, is to surrender empiricism at once as it has all along been held in history.

Keeping this distinction in view that the *process* of innervation must be distinguished from the *sensation* of innervation, we return to the relation which it sustains to motor sensations, or the consciousness of motions. Now while the innervation itself will precede and cause motion and so far occasion the sensation of it, it must be noticed that the sensation of innervation sustains no such relation either to motion or the consciousness of it. It is merely a

concomitant sensation of that phenomenon, a fact which Wundt has not recognized; but has entirely confused it with the causes of motion and motor sensations. The effort to exclude the idea of motion from the notion of confining the second element of the synthesis to sensations of innervation and separating these from motor sensations, only succeeds in implying that the consciousness of motion is due to the consciousness of effort. If the idea of motion contains nothing more than is given in conative states, supposed on hypothesis to exclude the notion of space, we have then the strange position that we can have the consciousness of motion without involving the notion of space, a position not only palpably absurd, but in direct contradiction with the admissions and assertions of Wundt elsewhere.* The fact is that innervation sensations are either capable of existing without motor sensations, as

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* Wundt. Phys. Psych. Vol II pp. 27 and 177

" Wundt. Logik. Vol I p. 464-467.

in the case of inhibited motion, or they are mere accompaniments of motor sensations. In neither case can they be the cause of motor sensations, as one sensation is never regarded as the cause of another. This brings us therefore to the dilemma in Wundt's position. On the one hand, he holds and must hold that innervation sensations are independent in their nature of motor sensations, and do not represent the consciousness of space. Thus and thus only can he exclude the space idea from the elements of the synthesis. On the other hand, as innervation or conative sensations are not the cause of motor sensations, the latter must be original elements of consciousness, at least in relation to the innervation states, both of them being parallel states of consciousness without the one having a causal power to produce the other, but both being the product of other causes in the background. The dilemma therefore is that he must hold the consciousness of motion which he admits to

contain the conception of space, to be an original datum of knowledge, making the idea of space knowable by another process than his synthesis of non-spatial data; and in direct opposition to this he chooses sensations unrelated to space in order to make the idea of space empirical. But even then it would not be empirical unless he decided the question whether the act of synthesis was natural or acquired. If we hold that innervation sensations are inseparably connected with the consciousness of motion the failure of the theory is manifest at once. Unless he maintains that innervation produces motor sensations he has no alternative but to admit the idea of space in one of his elements. If they are necessary concomitants of each other, a notion of space is included or known. If they have no necessary relation, motor sensations may exist without the consciousness of innervation and we have the derivation of space without resorting to the innervation of effort.

No doubt he meant to choose conative states because of their immediate relation to the knowledge of motion, but he forgets or ignores the difference between innervation as a process, and the consciousness which enables us to discover it. We present no objections to the view that the notion of space can be traced ultimately to innervation; for very likely all conceptions can be traced to such a source. But as a process it is not an immediate object of consciousness, while the theories of nativism and empiricism as already shown must be conceived within the province of consciousness: because they both make the question a historical one, not a physical problem of causes to be derived by inference. Now, it is only by keeping his mind upon innervation as a process that Wundt can exclude the factor of motion and the consciousness of it from the notion; but in any case this carries him outside the field of our contention and into a province where our question has neither the interest [illegible], nor the necessity of ex-

posing him. Thus he endeavors to keep the problem within the data of consciousness and chooses innervation sensations in order to satisfy the requirements of the case that no spacial relations shall be given in his data for synthesis he has nothing whatever to exclude the existence of motor sensations, while he evidently chooses innervation sensations for their affiliation with the motor. He has no resource to save his consistency but to abandon the question between nativism and empiricism and to explain the origin of the idea of space independently, or to admit frankly that there is nothing in his position to prevent the assumption that motor sensations are empirical data of consciousness, and that the notion of space is explainable by other than the synthetic theory even if it can be derived by the synthesis of peripheral and central innervation sensations. But it is evident that the law of parsimony will not allow the existence of both explanations, and much less the simultaneous existence of a the-

ory which makes the idea of space native in the original sensations of motion, and of a theory which makes it empirical.

There is still farther objection to this synthetic theory. The author is not always as consistent as he might be in the characterization of his data. The exigencies of the theory require that innervation sensations be distinct from motive states of consciousness, and that the two elements of the synthesis be capable of existing apart from each other, and without implying the idea of space. But the author says:—

"In fact we never know either the tactual or the innervation sensations to exist in a perfectly isolated state. Where the one or the other is found to exist, we find reproductions representing a complex sense product which always contains a space perception. It is therefore inconceivable that we should ever observe the elements of this perception in their original nature."* To criticise this, in the first

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* Wundt Phys. Psych. Vol. II. p. 27. Also p. 24.

place it is very strange for an associationalist, as Wundt avows to be; and as he has just advanced a tenet of that doctrine immediately preceding the passage quoted, to limit our knowledge to experience, and then while admitting that the elements of space are always connected in experience, to say that they are separable. It is true that they may be separable; but Wundt has no ground to make such a supposition.

And again supposing that "tactual and innervation sensations" are separable, so that even in experience as a fact they occur apart, what right has he to suppose that the idea of space is a synthesis of them? By his own statement the perception of space is always connected with them in experience, while as an empiricist he must assume that it is not necessarily so, unless he regards the synthesis as a contingent process. If the synthesis is the product of experience, then the idea of space might be necessarily connected with it and still be empirical in its origin. But on any other supposi-

tion it must be original, as the nature of the idea will in such cases be determined by the nature or empirical origin given it. This is of course a truism. But it is another proof of the fact that the ascription of the idea to this synthetic origin in no way settles the question of its a priori or experimental origin unless we determine at the same time the nature of the synthesis, or the mode of connection which the idea of space has with it.

Still further, if we separate the peripheral and innervation sensations from each other and still ascribe a possible independent existence to them apart from each other, as his theory requires, why deny a similar quality to the perception of space found in all experience inseparably connected with their synthesis? If we knew as a fact of experience that the elements of the synthesis could exist apart from each other and apart from the notion of space, the hypothesis of their synthesis to account for the third element in the complex would be

finited. But as the admission appears all three elements invariably bound up in experience, there seems no reason for adopting an analysis which will remove one of them out of existence and retain the other two, just to be able to propose a theory. This is to assume both the facts and the hypothesis which is to account for them. All legitimate scientific theories start with facts of experience and propose hypotheses to account for them. But it is a strange procedure to admit that experience does not present us with the facts necessary to a synthetic theory of space, and then in order to combat nativistic speculations, proceed to assume the facts in order to propose what is intended to be an empirical theory. But this is precisely what is done when the analysis of the complex product of knowledge disposes of one element in a way not employed with the others

All objections to the theory up to this point have been presented upon the supposition that its

claims regarding the nature of the elements, and the fact of their synthesis were true, but were directed against the contradictions and difficulties which were involved in its relations with other facts in the case, as well as the statements of the author. We have granted for the sake of argument that peripheral sensations and innervation sensations might exist in consciousness unaccompanied by the notion of space, and that a synthesis of them might be possible; but criticism was directed against implications in the theory which were in contradiction with it.

But a further objection is possible on the ground that Wundt has mistaken the whole nature of knowledge, and the whole character of the controversy, when he introduces the process of synthesis, after the analogy of the physical world, to account for a complex containing qualities not contained in its elements. It is of course a very neat analogy to compare the idea of space to water as a product of oxygen and hydrogen, or air as a chemical com-

binations of oxygen and nitrogen, and in each case the product containing qualities not found in the constituents. But it can be shown that such an analogy is utterly false, and that also it may act as a kind of "boomerang" if we choose to insist upon carrying the analogy out as it should be. We take the latter of these first. It is not true that all the qualities of the compound are entirely new in the cases of chemical syntheses. The elements had before their combination and carry over into the product those qualities unchanged and indestructible. Thus the elements of water contain weight, extension, impenetrability &c. and the compound also contains them, the weight being unaltered in all cases. No analysis of the compound will ever show that quality altered, or the others wanting, although the synthesis may bring out qualities in combination which were or are not in the elements. Hence not all the qualities of an element are metamorphosed by a chemical synthesis. It may be so with a synthesis in consciousness, and especially when the impression

is made that we do not know whether the elements of the space idea can exist independently or not. If peripheral sensations and motion states were known in experience to exist independently of each other and unconnected with space or its idea, the synthesis might have its rational probabilities; but the admitted fact that experience shows no analysis of the product makes both elements and the hypothesis assumptions as we have shown, while the element of space in the product may, like weight in the formation of water, still exist in the sensations constituting the elements of the psychic synthesis. And still further it must be noticed that the synthesis is not so complete by the hypothesis as might be desired: for far from betraying no evidence of the nature of the elements entering into the composition the two kinds of sensations are found unmetamorphosed in the product of the synthesis. The theory requires that the result of synthesis should show none of the qualities possessed by

the elements, while as a matter of fact we all perceptions of space the two sensations are constantly recognized by consciousness, especially in investigations. If the synthesis were completely like that of physical and chemical synthesis as defined by Wundt the elements would be entirely swallowed up in the product and we would have only the perception of pure space without any consciousness of sensations other than space. But the fact that we are conscious of both these sensations and of the space content and can distinguish between them goes to show that there is no such synthesis as Wundt assumes. Hence his theory breaks down in two ways

1st chemical synthesis does not destroy all the qualities of the elements and create entirely new ones.

2nd In the perception of space the elements supposed to constitute the synthesis are found in the total object of consciousness precisely of the same nature that we must give them when we assume them unconnected with the idea of space.

in the best of these cases the author can retain the conception of a synthesis only by arguing that we do not know what the sensations would be apart from the cognition of the total product, and that in the form of independent elements they might have very different qualities than appear in the compound. But this is to surrender empiricism at once: for the inability to conceive space and these sensations as apart from each other is the fundamental postulate of certain nativists, while empiricism requires that we be able to consider them independent of each other. So also do the physiological instances quoted by Wundt, and the conditions of his own theory.

But a stronger objection, and it is the second one under discussion of the idea of space as a synthesis, is that there is no analogy whatever between a physical and a psychical synthesis. The cases of mental synthesis of which we know anything are those of memory, association and the formation of conceptions, judgments and reasoning. In all of these the product contains

only the elements and their qualities. There is no such metamorphosis and production of new qualities such as appear in physical and chemical synthesis. A conception is a simpler illustration than the more complex ideas involved in judgments: but it contains no such elements as are given in sensation and consciousness and they can all be picked out from each other and made distinct by analysis. We may say thus that a conception is the sum of its elements. At all events, we never suppose it a synthesis of elements which are entirely different in nature from the parts of the whole: Each element can be a separate object of consciousness according as it is the object of a single sensation, and as such it undergoes no metamorphosis in composition with others. All the syntheses of memory and association contain precisely the elements given in the original experience with all their qualities intact, and add only another experience without any such transformation of properties as takes place in the union of oxygen and hydrogen to produce water.

If it be said that we do not know but that every act of consciousness, be it memory, association, conception, or even perception and sensation may be a synthesis of elements which have changed their properties in the course of the synthesis, we reply that there is no objection to the supposition of such a thing beyond knowledge or consciousness. What we contend for is that there is no such synthesis to consciousness. The whole problem is one of consciousness, or the theories of nativism and empiricism are entirely irrelevant. In discussing the origin of the idea of space, we are endeavoring to ascertain its history in consciousness, especially when we profess to be empiricists. To say, therefore, that there may be a synthesis which we may not know of is to surrender the whole historical question, and to seek conditions independent of knowledge and consciousness which may be necessary to those states, but it does not in the least satisfy the requirements for giving the historical origin of the idea of space in consciousness. Every

synthesis in knowledge, quite in contrast to what is called synthesis in physics, contains in the product the unchanged product of the elements: this knowledge is but the sum of the individual elements of consciousness, and they are after the synthesis what they were before it, and what they are known to be before it. This conclusion is evident from even Wundt's supposition, namely, that peripheral and innervation sensations may exist and be known independently of localization in space. If the idea of space were a synthesis of them, they with their presence in consciousness would be entirely lost to knowledge, and we should not be able to perceive them as concomitant with the consciousness of space. But unfortunately for the synthetic theory although we may be conscious of these sensations apart from the space idea, they are still found intact in connection with the consciousness of space which is in direct contradiction to the presuppositions of the theory.

And again in as much as there is no example of psychic synthesis elsewhere in mental processes

the supposition of it in the case of pure perceptions is not supported by analogy nor by anything known in experience.* It is therefore excluded from empiricism by the very terms of the hypothesis. Besides, scientific theories proceeding as such are extensions of well known principles, and not the invention of new ones. The theory of phlogiston was replaced by that of undulations which were simply forms of motion already known. The discoverer of gravitation invented nothing new in general experience when he proposed his theory; he only extended the well known principle of attraction, and made numerous phenomena intelligible by reference to ordinary experience: an explanation by known principles. But the synthetic theory is no such an explanation: it is not a reference of phenomena to any admitted principle of consciousness, and hence is nothing but a gratuitous assumption at the most; and although it may be true, it has nothing to do with experience and empiricism which it is invented to support.

And again why limit the synthesis to sensations

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* Mind, Vol. VIII, p. 33.

that are peripheral and innervations? They differ as sensations only in kind, and the difference in kind is as great between different peripheral sensations as between the two kinds chosen. If a difference in kind is all that is required, that condition is supplied in the sensations of peripheral sensations as well as in the difference between the so-called peripheral and conative states of consciousness. But the fundamental condition of the theory required that some sensation should be selected which was not a motor sensation, but as nearly related to it as possible, in order to avoid the supposition that localization would take place without those activities connected with motor innervations. Unless this could be done, perception of space in vision would be explained without muscular sensations of the eye, and this would be to grant the nativistic position. It is possible to show that localization and, therefore, the idea of space, may take place without the consciousness of muscular innervation, and hence the notion arise independently of one of the elements. But we shall pass this question by untouched.

Dr. Wundt's object seems to have been to vindicate Kant's theory of the ideality of space upon an empirical basis.* He thought by making it a synthesis of sensations objectively caused, that he satisfied the requirements of Kant's synthetic processes. But he has entirely misunderstood and misrepresented Kant's view of synthetic experience, synthetic judgments and synthetic mental states generally. Kant never dreamed that synthetic processes in knowledge were to be compared with the synthesis of physical elements to form material compounds. A synthetic element in knowledge with Kant was an additional element to experience and furnished by the mind. His synthesis was not a transformation of two or more elements of experience into inseparable compounds, but the union of _aposteriori_ elements in experience with _apriori_ and subjective elements from consciousness, or with the conditions of knowledge.

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* Wundt. Logik. Vol. I p. 460.

Space was a synthetic addition to the total of consciousness made by the mind's own activity, and not a metamorphosis of sensations. Hence for Wundt to identify his own view with that of Kant is only to betray his utter ignorance of that philosophy. There are no necessary affinities between them because the same term happens to be connected with both of them. Synthetic means one thing in Wundt's theory and an entirely distinct thing in Kant's conception of the problem.

In conclusion we have the following results regarding Wundt's theory.

1st If true, the theory is irrelevant to the problem of nativism and empiricism.

2nd The theory does not account for motor sensations which may originate the notion of space independently.

3rd There are no analogies between physical and psychic syntheses, and no such psychic syntheses as claimed known in experience.

4th The theory has no affinities with the Kantian view which it claims to support.

We take up next the theory of Helmholtz under the special empirical theories to be examined. Helmholtz is an empiricist, and does not, like Wundt undertake to compromise with nativism, or to conciliate opposing views. His empiricism is thorough, clear, and universal; but is also general in its nature affirming no special processes apart from common experience.[1] It is by far the strongest and best presented of all the empirical theories and is thus calculated to give empiricism the appearance at least of completely supplanting nativism. We shall better understand the whole problem by a criticism of it. But it must be observed that the objections raised against it are not to be interpreted as a disproof of empiricism generally, nor as a disproof of Helmholtz' explanation of the notion of space, nor as a refutation of his theory in itself. We still propose to pursue the method of conciliation, and hence we shall limit criticism with the purpose of establishing the nativistic results.

1st That Helmholtz has entirely misunderstood and misrepresented the theory of nativism in general, and in particular has partly misconceived the views of those from whom he took his conception of it.

2nd That many, if not all the fundamental assumptions and arguments made to prove empiricism are inadequate for that purpose, and are compatible with the opposite theory: and this without disputing in the least the validity either of his facts and of his inferences from them to explain the idea of space and its origin.

That Helmholtz is governed in his conception of nativism by the anatomical and physiological theories of Müller, Panum and Hering, is evident from the following references.* In these

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*Helmholtz Pop. Scien. Lectures. 1st Series pp. 240-3, 253, 263-4, 275

Helmholtz. Phys. Optik pp. 441, 556, 594, 616, 805-810

science the author constantly objects to the anatomical conditions invented in support of these nativists to account for the perception of space and the whole of his argument is directed to disprove the fact of such supposed conditions. But Helmholtz also identifies nativism with the theories of these men and then identifies empiricism with the similar theory of supposing as little as possible innate in the structure of the sensorium. He says, the empirical theory "does not assume any peculiar modes of physiological action in the nervous system, nor any hypothetical anatomical structures, but only the well-known association of impressions we receive and the conclusions we draw from them according to the fundamental laws of daily experience."*

Two replies can be made to the impression left by such language which is a sample of what is expressed in every reference we have given.

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* Helmholtz. Phy. Sens. [illegible] of Vision p. 267. Translation

First, we deny that nativism essentially assumes more than empiricism in such cases, and Helmholtz might have known this from the position of Kant and all his predecessors in nativistic views. He has spoken as if nativism were never heard of until the speculations of Müller and Panum were proposed. Besides he has failed to notice that their physiological theories were rendered necessary to account for the subjective and ideal nature of space and to preserve its apriori origin it was an incidental implication of the anatomical structure of the sensorium. Now, Helmholtz's view that space is purely an inference and an unconscious inference of the mind at that, with his tendency to favor the Kantian view of space generally, not only takes the notion of space away from sense perceptions, to which Kant confined it, but refers it to the understanding and creates a system of intellectualism and transcendentalism which is far worse than that of Kant. Kant's reference of space to subjective laws, and

especially to the activity of the sensorium almost compelled subsequent students to find the ground of its perception in the nature of the organism, and not in the nature of the activities which served as stimuli from without. Such features of the organism or sensorium as would produce the perception of space would hardly be anything else than native, at least in their germs, and hence to escape such a conclusion Helmholtz has to refer it to a process like that of the understanding, taking it entirely outside the material of sensation; but unfortunately he makes it an unconscious inference, a process which excludes it alike from experience and all known mental analogies while it prohibits him from regarding it as an abstract idea. The consequences of such a supposition we have to examine again.

Similarity has no right whatever to limit the conception of nativism to the physiological speculations of certain physiologists. It is by no means limited to the truth of admitting hypotheses about-

the nature and structure of the sensorium, at least within the possibilities of anatomical dissection. It is no more difficult to suppose the relation of space notions with the known conditions of the sensorium than to suppose the various sensations relative to the same conditions, which latter alternative is nowhere denied.

But the second reply is that Helmholtz has not fairly represented the hypotheses of Panum and Hering whose theories he criticises at length. In the first place his whole discussion leaves the impression that their theories are incompatible with the influence of experience in the problem, when the fact is that Hering admits over and over again that experience alone will explain certain phenomena, and these phenomena constitute the whole field upon which Helmholtz' empiricism is founded. Besides Hering is much more free from the purpose to support a special theory in his hypotheses than Helmholtz in his speculations. He very seldom refers in any of his writings to [illegible] nativism

or empiricism, and in two distinct places states that his hypotheses have no reference to either of these theories.* The refutation of them, therefore, accomplishes nothing against nativism, and nothing for empiricism. This is especially true of Panum's famous suppositions about "binocular synergies". They are merely statements of facts in vision, and the one concerning the perception of depth not a statement of mathematical relations in the perception of space whether native or empirical. This is shown by the references below.**

We admit, however, that the polemic of Helmholtz against all such subsidiary hypotheses as those of Müller, Panum and Hering is well founded and successful in the sense that they only complicate

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* Hering. Beiträge zur Physiologie. p. 145. and Du Bois-Reymond's Archiv für Anat. u. Physiol. 1865. p. 105

** Hering. Beiträge zur Physiol. p. 32.
Aubert. Physiologische Optik p. 6.6.
Wundt. Physiol. Psychol. vol. II. p. 171

the problem. They are entirely superfluous and unnecessary; although they are not inconsistent with either view of the case. The chief objection which Helmholtz should have raised against them would have been that they explained nothing and were entirely irrelevant. It was not necessary to overthrow them as facts in order to support empiricism, because it could be shown that they were irrelevant to the problem except so far as they begged the question; and in this respect they were no solutions. They might be true or false without affecting the problem one way or the other so far as they were unwarranted assumptions of facts; and their innate nature was an assumption. Hence we have no inclination to criticise Helmholtz in rejecting the positions of his opponents. For we not only admit that his refutation is successful, but we also maintain that nothing is thereby made out against nativism, except so far as he identifies it with these views. But the main fault of Helmholtz is that he leaves the impression, that

Hering does not admit the influence of experience in the origin of the notions of space. Now if we can show that Helmholtz's facts experiments and arguments in favor of empiricism and against nativism only prove a position which Hering admits is experiential, and that Helmholtz does not approach the field of Hering's nativism, we shall have made out the consistency of the two views. The whole of Helmholtz theory is directed to prove that distance size, localization &c are not innate. His experiments and illustrations given on the standard and his many cases of illusion to prove the contradiction between experience and the supposed unchangeable product of innate powers show this to be the case.* His refutation of Hering is conducted on the supposition that illusions, and the variations of experience from the fixed standard of nativism will disprove

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* Helmholtz. Physiol. Optik. pp. 427–457. 598–638
" Pop. Scien. Lect's p. 246–247.

such a theory. He assumes that the two theories are incompatible with each other, and involves that Hering without one of them. Hence the success of his argument against Hering's subsidiary hypotheses seems to militate against nativism, merely because he has supposed that investigator had reference to the same objects as himself. The difficulty with Helmholtz is simply this, that he fails to distinguish between indefinite space, or the content of consciousness in which a space element is given, and those judgments in which particular quantities and relations of it are expressed. An examination of his investigation will show that he is entirely concerned with the latter. Unfortunately for his assumed contradiction between the two positions, nativists have seldom, if ever, held to innate accuracy in distance, magnitude and localization. Most certainly Hering does not; but refers them to experience precisely as Helmholtz claims for them.

That Hering admits the influence of experience to the full extent claimed for it by Helmholtz, and that it

The proper explanation of magnitude, distance, direction localization, vertical and horizontal position, and solidity, in the definite conception required by Helmholtz' empiricism, will be made evident to any one who will consult the following references.* They will show also that he does not as Helmholtz suppose a contradiction between notions and impressions, and also that he is much more free from theoretical prepossessions than Helmholtz, although the latter shows more scientific judgment.

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* Du Bois-Reymond's Archiv fur Anat. u. Physiol. 1864. p. 282-3

* Hering. Lehre vom Lichtsinne p. 3-4

* Hering. Binocular Sehen. p. 6. and 18-23.

* Hering. Beiträge zur Physiologie pp. 14. 33. 62. 66. 67. 77
83. 135. 145. 269. 288. 295. 303. 320. 323. 327.
328. 329. 335. 336. 339. 344.

This is especially noticeable in his positive statements about magnitude, distance and illusions pp. 14. 33 66. 288. 320. 323 335 and 336.

* Wundt. Physiol. Psychologie. Vol. II. p. [illegible]

* Ribot. German Psychology of To-day p. [illegible] (Introduction).

But the mistake of Helmholtz is in supposing that Hering's fundamental position is opposed to his own view of localization, direction &c. while as a matter of fact the two are discussing two entirely different questions, except so far as Hering leaves the impression that his innate sense of the retina for height, breadth and depth determine definitely the amount of extension involved in every picture or not. This however he nowhere affirms, but on the contrary denies, although he has encumbered the simplicity of nativism by needless additional hypotheses. His fundamental position is that the eye contains in the content of its perceptions the element of space which experience develops into definite determinations. This latter position covers the whole field of Helmholtz, so that his reference to illusions and variations of judgment in distance and magnitude are no disproof of nativism although they may disprove some or all the inferences supposed to be drawn from

Hering's speculations. Still when Hering was imagined to experience the same field precisely which Helmholtz claims for it, the latter should see that most of his experiments and arguments fail of the mark at which they were directed. Nativism affirms the original and necessary character of the idea of space; but not that all our judgments regarding its quantity and relations of objects in it are correct. Helmholtz's whole argumentation, both in his "Optics" and his "Popular Scientific Lectures", are concerned only with this latter question, and it is easily made out. But it is no disproof of nativism, as such phenomena are relegated to experience by nativists.* Besides, Helmholtz admits that the present state of scientific progress cannot refute nativism.**

That Helmholtz's theory applies only to the definite

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* Bowne. Studies in Metaphysics p. 446.

** Helmholtz. Physiol. Optik p. 441. (1867)
Helmholtz. Pop. Scien. Lects 1st series p. 264

comparative and relative conceptions of space, and not to the original contents of consciousness and perception can be seen in the following references which we give without discussion.* The refutation of nativism therefore, as if it had the same conception of the problem is only to misunderstand the question. This will be made evident by an examination of the fundamental assumptions which are made in order to disprove nativism and to prove empirical theories.

As a basis for his view of the question Helmholtz makes four assumptions, and formulates three of them; every one of them is false and can be proved to be so. They are:

1st That nativism and empiricism are incompatible with each other, or that one must choose one or the other alternative.**

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* Helmholtz. Physiol. Optik. pp. 448. 530. 541. 602. 606. 607. 632. 800

Helmholtz. Pop. Scien. Lects. 2nd Series. p. 244 – 248. 267.

** Helmholtz Physiol. Optik pp. 435 441 – 445. 550. 616. 796 – 800

Helmholtz. Pop. Scien. Lects. 2nd Series pp. 240. and 263

2nd That nativism shuts off all inquiry into the problem of space.*

3rd That nativism necessitates a preestablished harmony between the mind and the external world**

4th That nativism contradicts the fact that many judgments of extension can be overcome by experience, and implies that no variation from a fixed standard in the perception of space can take place.***

The last three assumptions are formulated in the authors own language in the references, which will save quotation. But all four can be shown to be entirely false: the last one has been directly

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* Helmholtz. Phys. Optik. p. 556. 805 535

" Pop. Scien. Lect's. 2nd Series. p. 240.

** Helmholtz. Physiol Optik. pp. 442

" Pop. Scien. Lect's. 1st Series. pp. 242. 275

Ribot. German Psychology of To-day. pp. 130. 133. (Translation)

*** Helmholtz. Phys. Optik. pp. 438. 442. 606-607.

" Pop. Scien. Lect's. p. 264.

demand by Hering in three distinct passages; so that no conflict need exist between the two theories.*

An *ad hominem* argument from Helmholtz's own position will refute the first two assumptions, and show that the two theories are perfectly compatible, and that nativism does not shut off inquiry. Helmholtz holds that *causality is an apriori conception.*** He affirms that it is a principle which is not the product of experience, but innate in the constitution of the mind. But he dare not affirm that we are never mistaken in our judgment of particular causes, or that one judgment is never overcome in experience by another as regards the cause of a phenomenon. It is experience only that will enable

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* Hering. Binocular Sehen. pp. 6. and 18 - 23.

" DuBois Reymond's Archiv für Anat. u. Physiol. 1865 pp. 164-165

" Hering. Beiträge zur Physiologie p. 339.

** Helmholtz. Thatsachen in der Wahrnehmung. p. 4.

" " Phys. Optik. pp. 453 - 454

" [illegible] Physiol. Psych. Vol. II. p. 17[illegible]

us to determine particular causes. This everybody must admit. But it would not be true if his assumptions that apriori ideas could never admit of variations were true. He has regarded nativism and empiricism as mutually exclusive. If they are so he cannot hold to the apriori nature of causality, and the determining nature of experience in deciding particular causes. The case is precisely here as it is in the problem of space. If space cannot be apriori, because we find contradictions and illusions in judgments of space; neither can the notion of cause be apriori, because there are the same variations illusions and contradictions in our judgments of cause that we find in those of space. If Helmholtz had perceived the analogy he would have saved himself much controversy. For, as the apriori and innate nature of causality is not inconsistent with the variations and contradictions of experience nor shuts off inquiry regarding both the idea of cause and the particular causes of nature: so the apriori nature of the conception of space will be perfectly

compatible with all the investigations and experiments which Helmholtz has conducted, and with every form of illusion and contradiction in the comparison of individual judgments in experience.

The third assumption is disproved by the simple fact that nativism in the case of Kantianism does not assume a preestablished harmony between nature or the external world and the mind. No doubt most, if not all forms of Realism would assume this harmony. But nativism is not coincident and coextensive with Realism. It may and does include Idealism also, and there is no assumption of preestablished harmony necessarily made in this theory, so that we have no right to make this assumption characteristic of nativism in general. Lotze was a nativist and he makes no such a supposition.

The fourth assumption can be disproved in several ways. First, it can be disproved by showing the compatibility of apriori ideas with experience as we have done in the example of causality. Experiential

judgments of causes do not overcome or supplant the notion of cause as a priori, although they may displace other experiential judgments of causes. So it may be with the conception of space. We may discover in experience, as case after case has been recorded, that we may be mistaken regarding the magnitude and distance of objects, and yet the judgment regarding the fact of extension remain uninfluenced by these illusions and contradictions. References and illustrations could be given by the hundred, but the fact is a well known one. In such cases it is only judgments of experience that are overcome by others, while the native conception of indefinite extension is unaffected. In the second place, if the assumption be true, it can be shown from Helmholtz' own experiments and the illusions quoted by him in such numbers that the notion of space has never been overcome in a single case; but only previous judgments of distance, magnitude, direction, and position contradicted by subsequent experience. Indirectly, therefore, his experi-

ments, and the implication of the assumption in question, would prove nativism; because whatever the illusion, and whatever the error as to distance, direction, or magnitude the judgment that space accompanies the perception of the object is never overcome.

Still farther, the assumption is expressly denied and refuted by Hering against whom it is instanced as an argument. It is supposed that the nativist accepts it and that facts can be easily shown to contradict it. But if the nativist denies the assumption, and admits that experience may even overcome native tendencies and native conceptions it is no refutation of that theory to assert the assumption dogmatically. The error of Helmholtz is that he misconceives nativism as simply the innate notions of special and definite distances, relative directions magnitude and locality, and that Hering's view is this. He directly states it of Hering.* But Hering ex-

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* Helmholtz Physiol. Optik, [illegible] 815 [illegible]

" " Pop. Scien. Lect. [illegible] Series p. 29[illegible]

wholly denies this and accounts for them by experience precisely as Helmholtz does, as can be seen in the following references.* And again in two distinct passages he asserts the fundamental assumption that nativism is inconsistent with the displacement of one judgment by another:** and in two others states the domination of experience over native tendencies without arguing it.*** We mention one out of hundred of instances that could be stated to prove this. Certain portions of the sensorium are naturally very sensitive, but practice and use are known to make them very callous, so that they are less sensitive to pain than they are naturally. This is true of the hands and generally of the sense of temperature.

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* Hering. Beiträge zur Phys. pp. 4. 33 62. 288. 327-8

** Hering. Du Bois-Reymond's Archiv. 1865 p. 164-165

" " Binocular Sehen p. 18-23

*** Hering. Beiträge zur Phys. p. 339

" " Binocular Sehen p. 6.

Thus all four assumptions break down upon which Helmholtz founded the opposition between the two theories, and he is seen to have misrepresented the fundamental feature of Hering's view in order to refute it. No doubt some of Hering's suppositions were either mistaken or part or violated the law of simplicity in explanation; but they were not the conditions of nativism, and were were as consistent with empiricism as any other theory.* But we do not mean to defend Hering's position. On the contrary, we submit that the positive and negative values of different parts of the sensorium are assumptions that are either useless or gratuitous, and that they have no scientific value. The same could be admitted of the "height-breadth, and depth feelings" upon the retina. But we are concerned in showing that Helmholtz has made out nothing in favor of a contradiction between the two theories whatever may be the fate of Panum's and Hering's subsidiary hypotheses. This is made com-

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[*] Hering. Beiträge zur Phys. p. 45.

lies in the fact that he has misrepresented the latter's conception of nativism, and implied that he proceeded upon an assumption which he expressly repudiated. Thus it is not necessary to contradict Helmholtz's facts and arguments in order to defend nativism. That theory is confined simply to the field which he admits was the view of Kant, which he himself favors and which lies outside the object of his own investigation.* This is universal or indefinite space in distinction from particular space perceptions. It matters not whether the distinction is true or false, Helmholtz must construct his polemic according to the position of his opponent. He must either refute the distinction, or discuss the problem upon the lines laid down by Hering and nativists generally. If

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* Helmholtz. Thatsachen in Wahrnehmung. pp. 4–6

" Phys. Optik. pp. 456. 747. Also practically on p. 632

" Pop. Scien. Lects. p. 267.

Schwertschlager. Kant und Helmholtz. pp. 21–23. 49–55

he is to claim any scientific fairness in the case. Unless he does deny the conception of an indefinite space content in the original states of consciousness, he does not meet nativism on its own ground, and is only knocking down a straw man or an imaginary opponent when he proves that relative space conceptions like distance and direction definitely assigned are not innate. This has always been admitted by nativism.

There is still another misunderstanding of nativism to be noted, and its removal will contribute still further to the reconciliation of the two theories. Helmholtz constantly assumes that to be innate and intuitive the notion of space must be immediately transferable from one sense to another, that it must not only be a common sensible, but intuitively a common sensible; that sight would be able to identify at once the figures and forms given in touch.*

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* Helmholtz, Phys. Optik pp. 448. 602. 606. 612-613. 632.
" " Pop. Sci. Lects. pp. 238. 244. 265.

one of the passages in the references will show this. The author says: "Experience teaches that a child three months old learns very slowly at first to direct its hands toward objects, even if it already knows very well how to direct them to the mouth or itching portions of the skin, and consequently to govern its movements by sensations of touch."* In this conception of the problem, it is assumed that nativism must affirm the identity of experience between sight and touch; that is that the form, figure, magnitude, direction, of objects as known to touch would be known and recognized by sight at the first experience. Nativism does not necessarily do anything of the kind. It is possible to hold that the idea of space is native to both sight and touch, but to make it experiential as a common sensible. Nativism in its broadest sense merely holds that the idea is native to consciousness by one or the other of the senses, and may admit that all but one of the senses obtain it by experience. It may regard it as native to two or more senses and acquired to others. It may regard the notion of space

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* Helmholtz: Phys. Optik, p. 602.

as native to touch and acquired to sight, or native to sight and acquired to touch. Berkeley held the first of these, and Abbott the second.* Or again it may regard it as native to each sense, sight and touch; but that as a common sensible, as an identical object of both senses it is the product of experience. In fact this last is the position of nativists generally, and of Hering in particular; so that Helmholtz fails again in conceiving the problem rightly. It is not necessary to suppose that the perceptions of sight must be adjusted at once to those of touch before they can be regarded as innate. The question is not whether the space idea of one sense would be recognized in the first experience of another sense, but whether the product of that one sense contains a space element natural to its own activity. This will not be decided by pointing to illusions and conflicting judgments between the deliverances of two or more senses: nor will it be settled by pointing to illusions within the province of this single sense. It is conc-

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* Abbott, Sight and Touch.

possible to make out a very strong argument from actual experiments that the notion of space as a common sensible is native to both senses.* But granting that it is not native to both, nothing is made out thereby against nativism in every form as Helmholtz tacitly supposes. Locke was a nativist as regards the idea of space; but he answered Molyneux' question in the negative, and many regarded his answer as right, but as contradicting his theory of its origin. But as a matter of fact he was quite consistent, as it it is not necessary to suppose that the products of one sense are immediately cognizable in another except when both perceptions are in consciousness at the same time, in order to be a legitimate nativist: they are not transferable. Experience may be

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* Carpenter. Mental Physiology. pp. 181 and 189.
" Helmholtz. Phys. Optik. p 588 – 593.
" Abbott. Sight and Touch. pp. 140 – 162.
" Stumpf Ursprung der Raumvorstellung p. 294.
Wundt. Phys. Psych. Vol. II p. 178.

the condition of the knowledge that the two perceptions have reference to the same object; but it does not affect the native character of the deliverances of each sense separately. There is no more reason to suppose that form and magnitude would be identified except simultaneously than that colors and sounds would be referred to the same object without experience.

Thus it is plain that nativism and empiricism are not mutually exclusive unless they can be brought by further analysis to more definite problems. At least in the historical discussions of the space problem they do not appear irreconcilable; merely because the question debated by each party is not the same as that discussed by an opponent. It is true that at many points and in reference to many facts there is difference of opinion; but they seldom affect the fundamental issue in such a way as to free empiricism from the misrepresentations of nativism.

Nativism always has the advantage in that it almost [illegible] yield to empiricism.

There remains the most fundamental feature of all in the theory of Helmholtz, which must be considered. It is his doctrine of unconscious inference or unconscious association, as the explanation of the idea of space, and as the empirical view of it. We must add again that the discussion will not be intended to deny the existence of such a process as the author has called by the name of unconscious inference: but to show that it is neither a disproof of nativism nor consistent with empiricism.

That Helmholtz explains the origin of the notion of space by unconscious inferences may be seen in the following references.* They are also called inferences from analogy. By regarding the notions of space as an

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* Helmholtz. Phys. Optik. pp. 430. 449. 450. 632

" " Pop. Scien. Lects. p. 269.

" Wundt. Physiol. Psych. Vol. II. p. 1[illegible]

" Ribot. German Psychology of To-day. p. 123. (Translation)

" Stumpf. Ursprung der Raumvorstellung. p. 25

unconscious inference the notion can eliminate the language of those processes which we everywhere described under the conditions of empirical conclusions. Reasoning or inference is generally supposed to require experience to furnish material for the senses, however natural it may be as a mental law, and thus it necessarily be considered empirical. It sounds very propitious to me for empiricism if the notion of space can be called an inference of some kind. However it is carefully distinguished in every case as "unconscious". It remains to see what relation such a view has to empiricism.

In two respects unconscious reasoning is diametrically opposed to the theory of empiricism as it has ever uniformly been regarded by psychologists until recently. In the first place, empiricism is the theory, as we have already shown, which refers the origin of the idea of space to experience. Now, experience is a state of consciousness, or it is nothing. When we say that the idea of space is the result of experience, we mean that it is an

accessory and adventitious element of our sensations or sensational experiences, that it gradually grows out of them, and comes to consciousness subsequently to them, historically and logically. But to be experiential and empirical the idea must be a conscious experience developed from more elementary conscious states not containing it, and not involving it as a necessary consequence of their existence. Now an unconscious inference can be nothing of the kind. It is neither an experience, because it is not a conscious state, nor is there anything in its nature to enable us to decide whether it is concomitant with, or subsequent to, the most elementary states of consciousness: and unless we first decide that question it is nonsense to employ it in favor of empiricism. If the inference is below consciousness, it excludes the distinction between empiricism and nativism and virtually discusses the problem independently of these theories. Besides there is the same reason for making all our conscious states the product of unconscious

nervous; sensations resistance, sensations of color, sound resistance, odor, taste, temperature, memory &c. It may be that all these phenomena come into consciousness by reason of unconscious modifications which may be formulated physiologically and expressed in the language of experience; but such processes have nothing to do with experience. All our knowledge might be reduced to such antecedents; but in such resolution of it, we abandon the distinction between nativism and empiricism and adopt a principle which either defies all settlement of the question whether it is empirical or native, or is identical with the most radical form of nativism in the form of instinct. The problem of space as it is comprehended within the limits of these two theories is entirely within the domain of consciousness: the question is whether it is original or derived to consciousness; that is, whether it is a primitive element in our first states of consciousness connected with external stimuli, or whether it is an additional factor produced by repeated experience, and grad-

nally developed into consciousness, just as our knowledge of Physics, Astronomy, History, &c. are the product of experience. They are the result of comparing and explaining simple experiences which took place without evoking into conscious knowledge at the time those judgments which maturer powers can perceive and comprehend. Hence the question is whether the notion of space is an original and necessary experience concomitant with primitive sensations, or a contingent and learned experience which is not in its nature necessarily connected with consciousness at all. This is the form of the problem in which it is generally conceived. But there is another and it is whether it is naturally a conception of the mind characterizing its constitution without reference to the time that the notion appears in knowledge, even if it is unconnected with the primitive experience of sensation. Thus it may be conceived as a native function independently of its historical appearance in consciousness. But in either conception of the case the problem is considered one regarding the relation of the idea of

space to consciousness. Is it or is it not a necessary an element of our total consciousness in the sensations with which we find it connected? Is it an original and native experience, or is it the developed result of conscious experiences which originally contained none of it to knowledge? This is what is meant by the dispute between nativism and empiricism. But to explain it by the unconscious and palm off such a theory as empirical is only intellectual cowardice, or supreme ignorance. Unconscious processes are not experiences in any legitimate sense of that term, and by no shifting of logic or ingenuity can they be made such, whatever they may be. They are only an attempt to avoid the logic of facts and of nativism without employing the language characterizing that theory: and even then we shall see that such a supposition plays at once, both logically and by the implications of Helmholtz himself, into the hands of nativists. For, being unconscious, these inferences bear a stronger relation to what are called

native instincts, because they are so uniform and universal, and there is no need of considering the time when the result appears in consciousness. There is nothing irregular and haphazard about their occurrence, although their is variation in their products. But farther Helmholtz calls them a "blind force of nature" (eine blinde Naturgewalt) and an act taking place by "a compulsory necessity" (zwingende Notwendigkeit).[+] This makes it look very little like empirical processes which we understand to be merely contingent. But the characterization of them as a "blind necessity" only places them in the category of instincts which represent a most radical form of nativism. In this case they are very far removed from the experience of the individual and if necessary they must be the invariable and inevitable concomitant of sensations. Far then from being empirical and acquired they must be original as all blind instincts are.

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[*] Helmholtz. Phys. Optik pp. 431. 632.

Stumpf treats the doctrine of unconscious inference with considerable contempt, and thinks it is connected with the theory of [illegible] in which ultimately [illegible] [illegible] the subject.* So also Hering.** Stumpf's language is: "Whoever resorts to unconscious excitations has here as everywhere a very easy time of it in such problems. We have an unconscious knowledge of the retinal images as such; institute an unconscious comparison of both, and as we also already have an unconscious conception of bodies, we easily realize an unconscious geometrical conception that the two retinal images correspond exactly to the two projections of a material body in definite relations of the third dimension, and consequently make an unconscious inference that this at once such a body must be present and in consequence of this form an unconscious determination to conceive this body with consciousness."***

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* Stumpf. Ursprung der Raumvorstellung, p. 225.

** Hering Beiträge zur Physiol. p. 132.

*** Stumpf. Ursprung der Raumvorstellung. p. 225

But whatever may be thought of unconscious processes as facts to explain the idea of space, it is evident that they can do no service for empiricism, as they are affirmed to be such a necessary law of the mind that they are deprived of all the contingency assumed to characterize experience. Nagel's allusion to this makes it very clear, as a law of our being must be native.*

The second fact which makes the doctrine of unconscious inferences incompatible with empiricism, according to the postulates already given of it, is to be found in the nature of inferences. We have shown that empiricism to be true requires that the notion of space be derived from non-spatial data in consciousness: and now the question is whether inferences of any kind satisfy such a requirement. We shall examine, therefore, the nature of an inference, and its implications.

"Inference," says Hamilton,** indicates the car

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* Nagel. Das Sehen mit zwei Augen. p. 87

** Hamilton. Lectures on Logic. p. 70

ving out into the last proposition what was virtually contained in the antecedent judgments." This is simply a statement that an inference is founded upon a known and given fact of knowledge. We can draw inferences only from what is known; from what has been given in consciousness and experience. If the fact or truth to which the inference is made is not represented in the contents of the knowledge from which the inference is drawn, it is nevertheless suggested and legitimated only by the fact that it is either a fundamental law of thought which furnishes the datum for the inference, or it is some actual experience which constitutes that datum. In no other case can an inference be drawn. A content of knowledge must be given either in experience or in intuition in order upon any occasion to infer the existence of something similar to that knowledge, whether indefinitely involved in the conscious state at the time, or excluded from immediate presentation. Still the inference always implies that the object of that in-

perience has been given in consciousness. That is so so we refer to authority to name time and space.*

Helmholtz theory of space is his theory of knowledge. He maintains that we gain a knowledge of the external world by the interpretation of signs: these signs are sensations, and from them we infer the external spatial world,** although he calls this process of interpretation an unconscious inference. But leaving aside the question of unconscious inferences for the present, we have seen that a legitimate inference must assume a known principle whether apriori or of experience, before it can proceed to suppose or affirm the same principle in other present phenomena. If the idea of space is an inference from sensations, the principle must antici-

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* J. S. Mill. Logic. Book, II. Chapter 1st

" Jevons. Principles of Science. pp. 9. and 17.

" Herbert Spencer. Principles of Psychology vol. II, pp. 6–8

" Ueberweg. History of Logical Doctrine. pp. 225–228.

" Bain Senses and Intellect p. [illegible]

** Helmholtz Phys. Optic pp. 442–455. Sci. Lects pp 269–273

it would assume that some conception of space was in knowledge before those sensations took place, or that there was a nascent element of space in the sensations which required experience and logical processes to develop into consciousness. But to clear this up we must notice the kinds of inference with their implications. First there are two general kinds of inference, the mediate and the immediate. The former is still further subdivided into inductive and deductive. An immediate inference is merely the explicit formulation in consciousness of what is implicit in the conditions of it. If the idea of space is an immediate inference it is but the explicit recognition of what is already contained in the material of sensation, and hence in reality given in the original experience. This is nativism and not empiricism. And again, if it is a mediate inference, it may be deductive or inductive. If deductive it implies a previous knowledge of space in order to legitimate the inference, and empiricism is abandoned again. If it is inductive, it is still an inference

from the known to the unknown, and has the semblance of empiricism in that the object inferred is, in the inductive process, supposed not to be necessarily presented in knowledge at the time of the inference but only its sign. But nevertheless the inference is from known principles to what may be presented in further experience. The sign may not in consciousness at the time contain a presentation of the element inferred: but to infer its presence is only to seek in that phenomenon what we have had in experience before. Induction, as any other form of inference, proceeds upon the assumption that we must reason from the actual contents of knowledge whether a priori or empirical, to other experiences which must be tested in their appropriate senses and criteria. Thus we may regard the idea of space as an inductive inference to the sense of sound. But it may be that in no case shall we be able to discover a real spatial content in a presentation of hearing or sound, and yet our judgment of space associated with it prove correct. But to infer that space relations

may exist in connection with the consciousness of sound is to refer to another sense to test the truth of the inference. Mr Thompson assumes a knowledge of the idea of space independently of hearing in order to legitimate the inference of it in the case of sound. If it is not naturally connected with sound we could never infer it in vision from the sense of hearing. There can be no doubt that the idea is an inference to some of the senses; but to say the same of all of them is to generalize beyond what facts allow, and to utterly ignore the nature of an inference. We cannot infer the idea of space unless it has previously been in consciousness: and to suppose that it has previously been in consciousness is to grant the position of nativism. The doctrine of innateness is consistent with no other position. Wundt has shown this very clearly in two different places.* Lotze indicates the same principle.**

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* Wundt: Phys. Psych. Vol. II p. 174

" Logik. Vol. I pp. 454-455.

** Lotze. Metaphysik. pp. 233 and 242.

We cannot, therefore, regard the idea of space as necessarily and absolutely an inference, because such a process is always a relative one, dependent upon a constant antecedent to it and conditioning it. It may be an empirical inference in some cases, but this is only because the idea is assumed or given in experience before, and in the last analysis, unless we suppose an infinite regressus, inference must be traced to innate or native conditions. They can never be consistent with universal empiricism in the data which form the matter of the inference. So much, therefore, of the attempt to conceive the notion of space as a conscious inference. But what of the position that it is an unconscious inference? We have already shown that the unconscious state or mental modification so called, does nothing for empiricism, and is either outside of that controversy, or a proof of nativism. It now remains to deny its right to the name of "inference". It is only in the service of clear thinking that such a denial is made. There can be no reas-

no solution for either. It is inference but in the inevitable association of inference with empirical theories, and Helmholtz has the fault of conceiving the problem, its data and its conclusions in the mould of a preconceived theory. If the language of inference had in the least associated his theory with nativism he would have been the last to have chosen it. Besides it is impossible to conceive what is meant by an "unconscious inference", especially if we are to regard the data or "signs" as conscious. If the data upon which the inference is based are also unconscious, perhaps we might solve the problem or silence all opposition by referring everything to the unconscious. But although unconscious mental modifications may exist, and may account for the origin of the notion of space with the appearance of all ideas in the mind, they by no means solve, or even concern the dispute between nativism and empiricism. They are only the resort of a man who has already committed himself to the theory of empiricism and has resolved not to revise it

certain facts seem to indicate very strongly a sort of nativism; but having once adopted the alternative theory some mysterious process must be adopted which will look like empiricism, and evade the suspicion of the opposite theory. This is illustrated by his explanation of certain facts. We examine a few of his statements. He says: "It is quite clear that an infant, in spite of the greater size of its brain, and its power of mental development, learns with extreme slowness to perform the simplest tasks; as, for example to direct its eyes to an object, or to touch what it sees with its hands. Must we not conclude that a child has much more to learn than an animal, which is safely guided, but also restricted by its instincts? It is said that the calf sees the udder and goes after it, but it admits of question whether it does not simply smell it, and makes those movements which bring it nearer to the scent. At any rate, the child knows nothing of the meaning of the visual image presented by its mother's breast. It often turns obstinately away from it to the wrong side

and tries to find it there. &c."* Notice in this account both the misconception of the problem and the very singular shift made to escape the force of a fact. In the first place nativism does not necessarily depend upon the intuitive adaptation of touch to sight. No doubt infants have to learn by experience to accommodate the judgments of one sense to another: but to suppose that this is a refutation of nativism is to suppose that color is not native to sight because it is not immediately suggested by touch. Nor again does nativism in the least imply that a child must immediately know "the meaning" of its mother's breast before experiencing its power to satisfy its hunger. The perception of space does not include the meaning of the object perceived in it, and no one has the right to suppose that it does, unless he wishes to indicate his ignorance of the problem. If Helmholtz acknowledge that "the child has a "visual image of its mothers breast", he admits an original space content as its condition. The question is not whether the child interprets the

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* Helmholtz: Pop. Scien. Lects. p. 273

"visual image" exactly is not but whether space elements are present in the original visual consciousness, and Helmholtz has disqualified himself for denying it or implying its impossibility by saying, as we have mentioned, that it is impossible in the present state of science to refute nativism,* and that experiments with newly born children are impossible.** To demand that this "meaning" be known immediately with the "visual image", is to demand that the sensation of taste be native to the sense of sight: and this is but to ignore and evade the conception of the problem as defined by nativists. It is mere ignorance of the questions that would lead the author into such a representation of it. The same absurdity is observable in the explanation of the young calf's motions toward its mother's udders. In order to escape the

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* Helmholtz. Phys. Optik p. 441.
 " Pop. Scien. Lects. p. 264

** " Phys. Optik. p. 536

supposition that space is a natural percept of vision he speaks of the case as if it were the percept of smell. No author has ever had the audacity to suppose that space was the natural object of smell, or that the idea of it in vision was an inference from the experience of odors. All are agreed that any notion of space which odor may suggest is derived by experience from other senses. And farther, how does it come that the calf "makes movements in order to get nearer the smell"? What does it know of the significance of intensity in odors for indicating directions? Why not as well go in the opposite direction? Why not feel its way about space until chance or experience has taught it the combinations of sensations which may indicate the proper choice of directions? If it has no perception of space, why does it not stand and suck the air? Why does it move at all unless there is some perception of space in its consciousness? Is not the space element contained in its motion and the consciousness of it?

If such a being can "infer" the necessity of motion from odor, why not from sight? If it has an immediate sense or tendency to direction from smell, why not suppose it to be as reasonable with the sense of vision? The truth is that Helmholtz is afraid to admit the force of the facts, and is unwilling to make himself independent of theories in the case. It is an indication of weakness in his position that he should feel obliged to evade the force of the argument by making the problem one of smell, and insinuating that the idea of space was in its last analysis the result of odors. It were better that he analyze the problem with the conception that there are native functions to be admitted along with a field for experience, instead of assuming all along that the two theories are mutually exclusive.*

The conclusion to be drawn from this criticism of Helmholtz is, as we have said, not to refute his explanation of the origin of space, but to

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* Mind. April 1885. p. 229. July 1885 pp. 391 - 394.

show that he has not made out a conflict between the two theories of it considered in the most general sense possible. The object has been to suggest the possibility of their reconciliation and to remove the speculations about space from the exclusive claims of either party, and thus to make it possible to investigate the phenomena independently of either theory. The problem of psychic constituents should not be hampered by the question of nativism or empiricism; nor need the explanations of special perceptions of space, of illusions, and of mistaken judgments be in the least influenced by such theories. Had Helmholtz freed himself from the trammels which these theories have imposed upon the conceptions of the problem his services would have been much more valuable. But his whole discussion of it is marred by the supposed necessity of conceiving every aspect of it in the mould of empiricism, which fact has led him to an entire misconception of nativism, and hence to an easy conquest over it in that view of it.

II

Investigations of Facts and Special Questions.

1st Binocular Vision and its Relation to the Problem.

It is generally assumed that Binocular Vision has much to do with the settlement of the controversy between nativism and empiricism and elaborate experiments have been performed with that end in view. But we have as the purpose of a brief examination of this question to limit the scope entertained of such an assumption. The problem of space has suffered too much from its too thorough identification with certain subsidiary views in binocular vision, and it seems to have been one of the chief demerits of Helmholtz speculations that he has confused a general with a particular problem. The first inference to be drawn from a perusal of his theories is that they apply to the origin of the notion of space in every sense as well as that of sight, while he

certainly would have strengthened his case and avoided less controversy had he clearly and explicitly drawn the lines which he has occasionally hinted at between the general and the particular aspect of the question: because the conclusions reached in the case of sight cannot in his own showing apply to the sense of touch without separate investigation. This is made clear by Wundt's position.*

In the first place therefore binocular vision has nothing to do with the question between nativism and empiricism in its last analysis. At the most it can only concern certain problems of sight. But whatever conclusion is reached there, it will not affect the problem between the two theories within the field of touch. For our analysis, as well as historical examinations of the problem in the case of Berkeley and his school will show it possible for a man to be a nativist in the sense of touch and an empiri-

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* Wundt. Phys. Psych. Vol. II, p. 174-175

exist in the sense of sight. It matters not whether rightly so or not; the investigator has to discuss the question with such persons upon the assumptions which their analysis imposes, or show that such an analysis is impossible. The empirical character of space and its idea in sight may be perfectly consistent with its nativistic character elsewhere, just as all are agreed that the same idea is empirical to hearing, but would not on that account suppose it empirical everywhere. The deliverances of each sense have to be studied alone and it is well known that association and experience can bring into thought ideas in connection with sense perceptions which may not naturally belong to them; but this does not prove that they are not natural to any source of knowledge.*

The second question is how far does monocular vision affect the controversy between the two theories within the phenomena of sight? This can be answered only by seeing what is involved in binocular vision. There are two distinct problems in monocu-

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* Helmholtz. Phys. Optik. p. 797. The idea of space assumed.

lar vision: the combination of images, and the perception of the third dimension of space, or solidity. Although the last is connected intimately with the first, it is not a corollary of it; because the combination may take place where the third dimension is not present in the images combined. Now these two problems may divide the theories of nativism and empiricism without carrying the conclusions of the one over to the other. In the first place, it may be a problem whether the combination of images is a native or an empirical process, and it may be a separate problem whether the perception of solidity is native or empirical irrespective of conclusions in the former case as is indicated in the phenomena of binocular vision. Helmholtz has not noticed this distinction and argues against Hering's theories as if they concerned only the perception of space, while as a fact in most of them he steers clear of that question altogether. Now a man may be a nativist as regards the anatomical constitution and the psychical tendency of visual sensa-

tion of combining images and an empiricist in regard to the perception of depth; on the other hand he may be an empiricist in regard to combination of images and a nativist in reference to the third dimension of space. If it were possible to limit the perception distance to the mere combination of images it might be otherwise. But it is more intimately connected with other phenomena, as the experiments of Wheatstone show and as [illegible]; than with mere combination of images. The phenomena which are connected with the consciousness of distance are convergence, accommodation, visual magnitude, aerial perspective, and mathematical perspective, or the angular subtension of objects. This last is not the reverse of visual magnitude; aerial perspective refers to the clearness of retinal images. Only one of these is a necessary element and condition of binocular vision; namely that of convergence. But convergence in the production of combination of images does not produce the perception of solidity in the resultant com-

lens. There is a peculiar contrast for each motion, although it may produce a variation in the apparent distance of the image from the eyes of the observer: but convergence of itself in the combination of images does not produce the third dimension unless there is something in the content of the images to cause it. Hence binocular vision so far as it concerns the union of images may have nothing to do with the perception of space. We thus remove from consideration also the phenomena which Helmholtz discusses and considers of importance in this connection; namely, rivalry in contours, irregular mixture of colors, rivalry of colors, and irregular contrast.* These concern only the union of images, and not the perception of extension, unless we include the space involved in muscular sensations of the eye and certain real or supposed motor innervations of the retina noticed in rivalry during the motion of the eye: but in no case the third dimen-

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* Helmholtz. Phys. Optik pp. 766 – 777

" Pop. Scien. Lects. 1st Series pp. 252 - 263. (Translation)

Wundt. Phys. Psych. Vol. II pp. 155 - 161

sion, which is the only one ever intimately connected with binocular vision. Besides Helmholtz had admitted that the perception of distance and direction is connected with motor sensations of the eye, accommodation, aerial perspective, and retinal magnitude, all of which are monocular phenomena.* To prove, therefore, that solidity is an empirical inference in binocular combination of images from certain differential features of the two images will not in the least remove nativism from sight entirely, nor will it disprove that it is a native function of convergence. It merely shows that the empirical interpretation of certain signs in the sensations conforms to and comprises the perception necessitated by other causes. This is not to deny that binocular convergence has an important relation to the perception

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* Helmholtz. Phys. Optik. pp. 624. 629. 633. 800

Wundt. Phys. Psych. Vol. II. p. 177.

Ribot. German Psychology of To-day. pp. 122-126. (Translation)

of distance, not only that the visual sensations for the perception of single objects, but simple binocular combinations of images is not related to it. There must be a content in the sensation which will excite a particular kind of innervation in order to connect the notion of the third dimension with the combination of images. The perception of solidity is then due rather to this innervation in connection with convergence than to mere binocular combinations.* But whether we call this peculiarity innervation, or leave it undetermined, mere combination does not produce the perception of solidity, as can be proved by experiment.

But even if we do show that combination of images and convergence are to be kept distinct we do not complete the reconciliation between the two theories. Still we remove the perception of space from the mere question of combination,

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* Foster. Physiology. p. 551. 4th Edition
Wundt. Phys. Psych. Vol. II pp 104-107.

although distinctness and definiteness in the perception of solidity is concomitant with, and very materially aided by convergence: but so many other elements enter in to prevent the confinement of the problem to the mere positions of images upon the retina. Then for the relation of both these aspects to the theories of nativism and empiricism.

First, that there is a native arrangement and tendency to binocular combination of images can be made clear by two very simple facts, the innate existence of the fovea centralis.* and the symmetrical movement of the two eyes.** These symmetrical movements begin in the earliest experiences of vision, and it is in most cases impossible by any amount of volition and experience to overcome or reverse them. Accommodation is much more under control of volition

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* Le Conte. Sight. pp. 73-76. 266-269.

** Hering. Binocular Sehen. pp. 18-23.

" Wundt. Phys. Psych. Bd. I. [illegible]

although that is uniformly regarded as reflex and instinctive. But Helmholtz, supposing that binocular combination and convergence must be kept together in the problem of space and under the pressure of empiricism in the perception of solidity, found it necessary to question the native tendency to combine images. But this is sheer nonsense in the face of the facts we have mentioned, whatever may be thought of identical points different from the former contention. If we were to admit the assumption of Helmholtz that combination and convergence cannot be separated in the argument the case would be complete against him in the proof that the union of images expressed a native tendency of the mind. But the fact that the combination of images is concerned with single vision mainly and only incidentally with solidity, and the fact that it takes place in space independently gives no consciousness, or containing more than the same impressions are combined, requires that the two questions be kept distinct. Still the proposition that

combination is a native function, we find no *antinomious* presumptions against the positions of nativity. However it is not our present purpose to prove the view of nativism in the perception of solidity, but only that the phenomena of *single vision* must be kept distinct from the questions of space, however intimately associated they may be with convergence.

In the second place, the supposition that solidity is an "unconscious inference" from disparate pictures in the two images is no disproof of nativism, as we have shown in the examination of "inference". If it were an inference from other muscular sensations known in touch, or otherwise in vision it would give color to the empirical view: but not being able to assume any such possibility, the resort to unconscious states requires that we must decide whether they are native or acquired in order to provide any probabilities for empiricism. But granting that the solidity of objects whose images are combined by identical points, is an empirical inference from da-

ta not containing it, this fact does not prove the empirical nature of the third dimension generally in vision, because images are always projected according to accommodation and convergence irrespective of the data that may afford an inference for definite elements of it in the object producing the images. Hence whatever binocular combination may have to do with solidity of objects, it will have nothing whatever to do with deciding the controversy between nativism and empiricism, because it will not remove the monocular intuitions, nor cause the judgment of distance in binocular convergence independently of solidity in combined images, and independently of combination when solidity is not perceived. Besides it is possible to exclude binocular vision entirely from the problem and to rely upon monocular vision, as the third dimension is as natural to one as to two eyes, although particular distances and magnitudes are not so definite and accurate in monocular as in binocular vision. Still the sense of distance is as positive in one as in the other.

Binocular perceptions of solidity will, therefore, be of secondary importance, not being conclusive in favor or against either theory taken in some sense and in some relations.

It is not to be denied, however, that binocular phenomena have importance in explaining the phenomena of space perceptions, but most of these explanations are consistent with either theory, as the mere reference of the perception to a process physiological or psychological, is no decision one way or the other. We still require to know whether that is native or empirical. It must always be distinctly remembered that the causal explanation of the idea of space as a sense phenomenon does not decide the question between the theories, for the reason that it is a historical, not an aetiological question. If the cause of the idea is native, the product or effect is native. To make it empirical it is needful to show that in the historical development of consciousness the notion of space is subsequent to states with which it is not necessarily connected. Hence to point

out the cause of the idea, as is done in most speculations about both monocular and binocular vision. This is a very important fact for separating the question about the physical and empirical conditions of perception from the question about nativism and empiricism in their historical aspects. Since movements of the eyes, muscular innervation, accommodation, convergence &c. may all be admitted as conditions of the perception of space in general, and distance in particular without deciding one way or the other regarding the kind of origin involved, whether native or empirical, until the _historical_ character of these conditions be first determined. In this way we shall get a much more scientific discussion of binocular vision, free from the prepossessions of theories. The question, therefore, regarding the _physiological and psychological_ conditions of space perception will be kept independent of the _historical_ appearance of the idea in consciousness.

2nd The Relation of Illusions to the Problem.

Most empiricists, and especially Helmholtz in his investigations and his vast collections and discussion of illusions, have thought such phenomena a disproof of nativism. This is because illusions exhibit the contradictory judgments of the mind in regard to whatever is supposed to be native, and in particular here to the notion of space. It is assumed that native perceptions are invariable, and finding that the judgment and perception of space are variable and contradictory, just as the individual phenomena of experience are always assumed to be, they must make it fall into that class of phenomena. The idea of space is thus supposed to be empirical or experiential because illusions in the perception of it seem to contradict the stability and fixity assumed of native conceptions. But a few facts will show that they are consistent with either theory of space, and hence not to be used to decide the controversy. The case

be employed to prove nativism as well as empiricism, and hence must either be disregarded in the question, or the two theories admitted to be consistent with each other, but concerned with different aspects of the problem. That illusions generally are not inconsistent with nativism may be seen from the facts and admissions of empiricists themselves. The application of the argument to space in particular can be made as clear and as final.

In the first place, all empiricists admit that the perception of color is a native function of sight. It is also an established fact that illusions and mistakes occur in the perceptions of particular colors, and perhaps as frequently as illusions in the perception of distance and magnitude. But no one had dreamed of using such a fact to prove that color was an empirical perception. It is empirical in the sense that we can not conceive anything of it until experience, in the Kantian sense, takes place. But this experience is native and original, so that color is not the product of repeated experiences or more elementary. The

of consciousness. It is a native function; but this fact decides nothing as the particular judgment of color in experience. The different sensibility of different parts of the retina to the same or different colors gives rise to variations in the perception of color.* For instance, if a red pencil be first placed in the center of the field of vision and then gradually moved so as to throw the rays of light upon some portion of the circumference, or near the circumference of the retina, its color will appear to change, and become black. All objects will change the distinctness and clearness of the perception in such cases. Now in these cases there is a difference of judgment; but no one suspects on that account that the notion of color is derived from experience. Hundreds of illusions can be shown in the case of touch and hearing; but no one seems inclined on that account to say that the perception of hardness or resistance, and of sound is a modification of some other states of

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* Wundt. Phys. Psych. Vol. I pp. 430-433. 453-456
Foster. Physiology. p. 536.

consciousness. Nativism is here considered perfectly consistent with the existence of illusory judgments. Why can it not be so in the case of space?

The same argument can be adduced against Helmholtz in the case of causality, as we have already mentioned. He holds that the idea of cause is apriori and native.* But he cannot for a moment hold that it is not subject to illusions in particular instances: for the history of science is but one long account of perpetual blunders in the judgment of causes. We suspect that there are as many illusions and contradictions in the judgments of causality as in those of space. Why will not these facts overthrow the native character of that conception? It is because nativism is concerned only with the fact of causality, and not

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* Helmholtz. Thatsachen in der Wahrnehmung p. 41
" Phys. Optik pp 453 - 455
Wundt. Phys. Psych. Vol. II pp. 174-175
" Logik p. 454.

with impossibility in the determination of particular causes. It is so with the perception of space.

And again a third argument for the insufficiency of illusions to decide the controversy is found in the fact that whenever illusions of distance, magnitude and direction occur in vision they do not overcome the conception of space entirely; but only certain previous and comparative judgments of it. If we misjudge the distance of mountains, and discover by later experience that they are farther than the former judgment indicated, it has been a mistake between two comparative judgments, while the judgment that there is actual distance between the observer and the observed is common to both cases. The sense of distance is not overcome, although the particular distance supposed may be modified. If geometrical figures can be made to produce the illusion of solidity, this fact and the discovery that the figures are but plane do not overcome the sense of depth or distance. In many illusions of distance and direction there always

remains the same inextinguishable perception of some direction or distance whatever the variations of quantity and relation may occur. The fact is that distance, directions and magnitude are relative as well as absolute conceptions. Thus North, South, East, and West; up and down, right and left; vertical and horizontal, &c are all relative, as well as absolute. So far as they are relative experience must decide the correctness of judgment regarding them because as relative they are complex conceptions including associations and inferences that require other experiences to test them. Thus we may judge that a certain direction is East and find later that we were entirely mistaken; but still not in the least mistaken as to the actual direction from ourselves in the position we were at the time. This is because East is relative to North, South, West &c and so far as it is relative to them they must also be known at the time to prevent illusion. But there is no illusion as to the fact of direction. It is the same with the illusions of direction caused by injury of

certain muscles in the eye. We will be mistaken as to the *relative* directions in which objects are seen in such cases, but the sense of direction will be as clear and as unremovable as that of color, and this is all that is necessary to reconcile the case with a theory of nativism. So of magnitude and distance. Relative judgments of them may vary as the colors of the chameleon; but the sense of distance and size is not overcome by this fact. On the contrary the very fact of illusions would seem to point to native perceptions which cannot be overcome by experience. For it requires a perception of space in both cases and a perception of its different relations in order to be at all aware of an illusion. The illusion only shows that the judgment of space is not overcome; but that variations and contradictions occur only within the field of association with previous and *separate* experiences of space. As soon as opponents of nativism produce illusions of sense perception in which the sense of space in distance, direction and form is

and elimination
outside ourselves, and nothing left but unoccupied states of consciousness their cause will make a better showing. Helmholtz has admitted the force of illusions against empiricism.* Besides his discussion of illusions as the product of third psychological laws is consistent with the view that they prove native instincts. The activity of the unconscious and of the mind when it is so stimulated he regards as natural and necessary in the case of illusions.** This is only to admit that they are at least consistent with if not a proof of nativism. For the judgment of space is as invariably and as necessarily involved in illusions of distance, direction &c. as those of color & reality.

As a matter of fact illusions have a much more intimate relation to the question of idealism and realism than that of nativism and empiricism: and significantly enough while starting

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* Helmholtz. Pop. Scien. Lects. 1st Series. p. 268. Translation

** Helmholtz. Phys. Optik pp. 429. 437. 456. 798.

but to disprove idealism by disproving apriorism, empiricism is now tending wholly to establish idealism and transcendentalism. It was empiricists that have been the originators and the staunchest defenders of a fourth dimension of space. Now illusions have a tendency to refer the idea of space to the subjective, but not to remove it altogether, and hence they affiliate much more with the arguments for idealism than with any that are calculated to settle the controversy between the two theories of the origin of space consciousness historically.

The conclusion to be drawn from the failure to displace nativism by an appeal to illusions is, that scientific investigations of these phenomena and of the physiological and psychological conditions of the idea of space should not be hampered by the question of nativism or empiricism. The explanation of illusions can be carried on independently of these theories. They are not historical questions and hence the questions of nativism and empiricism will

[illegible] remains until an explanation of them is given. Illusions may show clearly enough that certain particular judgments have not the requisite constancy, [illegible] or generally released of them, but they are not sufficient to remove entirely the general impression that lies at the foundation of even the illusion itself. Hence they only enforce the necessity we have urged of separating the pieces of the two theories, and of making that analysis of the questions which will distinguish between the total perception of space including association and inferences transferred from one sense to another, and those original elements in the contents of individual conscious states which afford a durable aid for experience. Illusions belong to relational phenomena and to the associations of experience and do not affect the *quali*tative contents of consciousness which is the sole field of nativism.

An experiment will make the whole case clear. If we take two small circles upon a plane which are [illegible] and about [illegible] or [illegible] and [illegible] [illegible] [illegible]

Then, at a distance of about nine or twelve inches, converge the axes of vision so as to combine the two images stereoscopically several interesting phenomena may be observed. In the first place before complete combination takes place four circles may be visible; after combination three are visible. In the second place the central circle which is due to the combination of two images upon the fovea centralis, will appear located at a less distance than the two remaining circles whose images appear upon disparate portions of the retina.* In the third place, the apparent magnitude of all the circles is very much diminished, that of the central circle, which is the nearer and the result of combination, being the smallest of the three. The illusions here are those of number, distance and magnitude. Leaving that of number out of consideration as irrelevant, it is interesting to note

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* Abbott. Sight and Touch. p. 25. 121

Wundt. Phys. Psych. Vol. II pp 129-131

some characteristics of the other two. In the first place the central circle seems located at the point where the convergent optical axes intersect, as can be shown by placing a pencil point at the apparent locality of the circle. Both its magnitude and its distance from the eyes seem very much less than the two circles seen upon the surface of the paper when the eyes are unconvergent. In the second place while the two images upon disparate and non-identical points seem reduced in size they are larger than the central circle which is the result of combination and less than the two real circles upon the paper; but strangely enough seem at the same distance as in normal vision: that is, as far off as the real circles when the eyes are not converged. Now convergence has determined the apparent distance of the central circle, and accommodation the apparent magnitude of all three, although it is probable that convergence has influenced the apparent magnitude of the middle circle, because it seems smaller than the two outer circles. Thus there is

a variation from the judgments of what is called normal vision, altho the actions of the sensorium and of the mind ought to be regarded as normal at any degree of convergence and accommodation.

But the question now arises whether these illusions can be used to deny the intuition of space, or to disprove the native character of such a perception. If distance is a quantity variable with convergence there would seem to be no fixed standard on which to make the notion of the third dimension a definite one, and hence the accuracy with which we judge it will depend upon experience, and the happy junction of circumstances which come in to aid or confirm the results of convergence. Thus illusions show the conception of distance to vary precisely as the products of experience vary, and at least seem to class it with them. But that this result is not inconsistent with nativism is evident from the following considerations.

__First__, it must be emphasized that the distance of the visual circle is a matter of the __localization__

and not an assignment of limits to space. The fact that convergence and accommodation have not affected the apparent distance of the two outer circles shows this to be the case: for their distance, notwithstanding the alteration of apparent magnitude, remains the same as in normal vision. There is a distinct recognition of a dimension extending beyond that of the localized object in the centre. There is a great difference between assigning spatial limits to the locality of an object, and assigning limits to the solidity of that object. Hence the distance perceived in the case at hand is a localization of combined images, and has not affected the general spatial contents of consciousness. Localization of objects has to do with the definite quantities of space, and nothing with the spacial _quale_ of consciousness.

Second. The fact that under precisely the same circumstances there would be two judgments of extension, one identical with normal vision, and the other in accordance with convergence,

when we should expect the decrease in apparent magnitude of the two outer circles to modify their apparent distance, shows unmistakably that the judgment of distance may be made independent of convergence and combination. The influence of convergence may come in for more definiteness and perhaps to aid in the muscular adjustment of perception. But whether this be so or not, the third dimension even in binocular vision is not limited to convergence and combination which have to do with definite localization.

Third, if the illusion of distance be taken to disprove the native character of solid dimension, that of magnitude should be taken to disprove nativism in plane dimension, a position which even empiricists have hardly dared to assume. They endeavor to show how association and inference can produce the perception of solidity, when only two dimensions are represented in the image on the retina, but there is no effort to show how they will account for plane dimensions in the same way.

It is assumed as quite natural for the mind to be conscious of plane dimension, because the whole content of that percept is represented in the impression upon the retina. In this they assume what certainly exists; namely, a preestablished harmony between the external world and the mind, and Helmholtz virtually implies his assent to the assumption, because he is silent upon the explanation of plane dimension by inferences; or at least seems to be so on account of his exclusive attention to the question of solid dimensions. However the difficulty has generally been to account for the third dimension when it was not represented in the impression in precisely the same way that plane dimension was represented. But if illusion is hostile to nativism in the one, it will be so in the other: if contradictions in the judgments of distance are fatal to nativistic theories of solid dimension, so will contradictions in the judgments of magnitude be fatal in the same way to plane dimensions; and empiricism will be left to the

task of explaining plane extension by association. In fulfilling this task it will find that it must identify in nature all three dimensions, and imply their mutual dependence upon each other to consciousness, as Helmholtz in one passage admits, and Ribot in another and independent statement.* In that case there should be no difficulty in supposing the third dimension native to sight whenever it seems natural to suppose that plane dimension is so. But as binocular vision is not in the least necessary to the perception of plane dimension; as there is no attempt to explain it by other visual associations, and as the illusions of magnitude neither affect the general conception of two dimensions nor remove it entirely from the particular conception in consciousness at the time, the conception of space still remains as ultimate as the color and form of the object, and there are

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* Helmholtz. Phys. Optik. p. 622.

Ribot. German Psychology of To-day, p. [illegible]

admitted to be independent of association. The sensation is admitted to be ultimate and native. Now as illusion in magnitude does not remove the sense of extension and hence does not disprove nativism, neither will illusion disprove nativism in the third dimension. This is clear from the fact that the illusion regards the dimension of an object, and not that of space: the mistake is not in the mental construction of the third dimension, but in the judgment of the correspondence in the object with that construction. The construction of space may be natural in the case, as it is not overcome in localizations; but the failure of the object to conform to that construction has to do with the perceptions and judgments of objects and not with space in general consciousness.

Throughout the whole experiment, in every aspect of the case, the consciousness of space remains, and is never overcome by illusions that show its relative conceptions variable: hence they do not invalidate [illegible] the supposition of nativism. This is confirmed [illegible] the

more evident when we note in the experiment that convergence cannot be taken as the only psychic constant for the third dimension. The consciousness of extension beyond the localized object in convergence indicates that localization of particular objects with the definite judgment of space does not exhaust the elements in the problem. Innervation, accommodation, and movement may have much to do with it; so that the presence or absence of any one element may modify the judgment of infinite space, without ever removing from consciousness that content which is distinctly a space construction. There is a _quale_ in consciousness, which accommodation, convergence innervations, muscular sensations, motion &c may _quantify_ according to their combined or individual influences, and variations of judgment take place when there is comparison between these relative standards. Illusions are, therefore, confined to the relative phenomena of experience and do not suffice to overcome the consciousness of a spacial _quale_.

Scientific investigators forget entirely that the localization of objects has nothing to do with the assignment of limits to spacial *qualia*; and that the ability to indicate the causes and conditions of the several judgments of magnitude and distance has nothing to do with the *historical* question between nativism and empiricism. These variations and contradictions of experience as they appear in illusions may be a proof of the subjective and ideal construction of space, and it may require experience to obtain anything like a reliable constant, or relative adjustment of different experiences in order to measure the accuracy and definiteness of space impressions: but neither the physiological and psychological conditions of localization, nor explanations of illusions affect the question regarding the *historical* appearance of spacial elements in the contents of consciousness. These conditions themselves may be constituent elements of sensation, and their nativism or empirical character must be determined before they can decide the question one way or the other.

3rd Experimental Aspects of the Problem and Elements that Affect the Notions of Space.

The results of experiments have been so different that they have complicated rather than simplified theories of space. The motives which have instigated inquiry and the influence of theoretical assumptions upon interpretation have too often determined the way facts should be observed and explained, and we often find opposite theories supported on precisely the same experiments and their results. Such a fact alone might suggest a possible reconciliation between the two views; but it is well nigh a hopeless task to thread one's way through the inextricable maze of speculations and experiments to any well defined and comprehensive conception of the whole problem. It is the desire of every inquirer into the subject to attain clearness and simplicity in it, and hence the general effort to obtain a 'brief' statement of the case with a comprehensive solution of it. But

the magnitude of the question, its complicated relations with so many other subjects, and the mass of ever new and surprising details defy every attempt at a briefly synthetic conception of it. Nothing will disentangle speculation and reconcile theories but the most elaborate analysis ever undertaken in a scientific problem. Even the analysis which our introduction has given may not be more than half the extent to which it must be carried in order to exhaust its possibilities. It seems confused enough when we have discovered how complicated the five senses, the three dimensions, and the two kinds of space, definite and indefinite can make the problem to be solved by the two theories; but it is much more complicated when convergence, accommodation, muscular innervation, motor sensations, aerial and mathematical perspective, retinal magnitude, and various psychological processes are added to those above and combine to modify every impression upon the sensorium. Single facts therefore will go a very little way in satisfying all the requirements of the problem, although they may have

sufficient influence to define the limits of both theories in those special cases. This will be enough to establish at least a partial reconciliation between them. Such a mediation we wish to carry farther than previous special questions would allow. We do not believe that the two theories offer an alternative between them: it is only a question as to the extent and limits of both. In special individual phenomena they may offer an alternative, but not over the whole extent of knowledge, and it is the part of the scientist either to reconcile them or to pursue investigations as to the nature and origin of the notion of space independently of the question whether it is native or empirical. We believe, however, that both of these can be done.

In the first place, the conception we have of space when undertake investigation may determine the position to be assumed in a theory. This conception may be such as previous education or habits of reading and reflection have formed. If our mental experience has in any way given us a tendency for estimating things, or

it is quite sure to do in some particular way rather than another, this influence will come in to define more or less sharply the mental attitude toward every theoretical problem that divides speculation. The notion of space will not be exempt from such influences in deciding the way theories of it are to be regarded. The conception we may have formed not only of it, but of its relation to the other intellectual ideas and metaphysical doctrines that we inevitably involve, whether we will, or not, will come in unconsciously to influence and perhaps determine the way we shall discuss the theory of its origin. This is quite obtrusive in the theory of Helmholtz. Regarding space, in general in accordance with Kant, as of psychological instead of a physiological origin, his whole discussion of the question is directed against the supposed view of it which would identify the external and internal world. He shows this fact by his protest against the realistic view on the ground that it assumes a preestablished harmony between the external and the internal world. He objects

because such a view implies in the sensations and impressions the presence of the very qualitative elements which the untutored mind assigns to externality. The nativism which Johannes Müller and to some extent that of Panum and Hering, although intended to vindicate at least one feature of the Kantian view, seemed to Helmholtz to destroy the second and more important feature; namely, that feature which enabled Kant to define so sharply the difference between the subjective world, and the nature of things affecting the sensorium. Hence by making it a mental judgment or an inference it became a psychological, and not a physiological process; and so regarding it as an interpretive act of mind he could best account for the variations it represented in experience, and make more thorough and consistent the distinction which the subjective character of sensations presented between the subject and the object. The field of judgment being generally admitted to belong to experience, and the illusions characteristic of sense perceptions, being associated with empiricism from the

time of Protagoras would inevitably influence his mental attitude toward the subject. But he seems to have entirely ignored the fact that nativism is as consistent with the idealistic view of the problem as empiricism, and that independently of the question whether the notion of space has a simultaneous historical origin with sensation or not, other and perhaps fatal associations connected with empiricism, and which are the chief, if not the only ideas involving the hostility of nativism he seems not to have been conscious of. Besides he never seems able to isolate the conception of space for each sense supposed to present it; but invariably thinks of it in the more or less perfected form of mature knowledge where it is complicated very evidently with a great amount of experience. He seems to think it must be common and native to two or more senses, or not native at all.* This is also the view of Bain.**

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* Helmholtz. Phys. Optik. pp. 444. 606. 632.

" Pop. Scien. Lectures. 1st Series. pp. 244-248. 267

** Bain, A. Senses and Intellect p. 394.

Such a preconception of the case must determine a man's whole attitude toward the two theories unless he presumes the necessity of analysis. If that assumption had to be granted it would at once and forever settle the side which scientific thought would have to take in the question. But is, as we have shown, an entire misunderstanding of the real question at issue, and it is unfortunate that it should operate to vitiate nearly the whole of a man's investigations upon the subject.* But it demonstrates the extensive influence of preconceptions that may be as capable of analysis as the questions in dispute. If they had been analyzed, they might have saved much useless speculation and controversy. For further mediation between the theories some analysis will be suggested.

If the conception of space whose origin we seek to ascertain, be that conception of it which is usual to mature reflection; namely, the complex result of various experiences in different senses, there can be no doubt about the claims of empiricism. This complex conception of it is the combined associations of

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* Lotze. Medicinische Psychologie, p. [illegible].

two or more senses that suggest each other must come be acquired by the proper experience, and hence it is no wonder that a mind, assuming this view of it, would maintain that a visual perception will not instinctively and necessarily determine the number of steps or amount of muscular exertion required to bring an object into contact with the sensorium. This, with the implied adjustment of one experience to another must be handed over to empiricism, in the sense that repeated realization of disparate experiences in conjunction must take place to originate and verify such a complex result. But we should remember, on the other hand, that a broad distinction may be drawn between the identification of the two or more elements in the resultant, and those elements as contents of individual perceptions. That is, although the identification of tactual and visual space may be empirical, this is no proof that tactual and visual space as *proper* sensibles are empirical. But this has already been made clear.

However it is the necessary introduction of a [illegible]

and conception of space which may influence the theoretical attitude of the mind. It is the assumption that space is an abstract conception formed by generalization. In this case also there is no alternative to the admission of a large influence from experience. Experience is required for all general conceptions which comprehend disparate phenomena or objects in their extension. But a distinctive feature of such a position is that it always implies original elements out of which the abstract general conception is formed. General conceptions contain qualitatively the elements of their originals. Grant that the idea of space is a general conception from the disparate sensations of sight and touch, and that as a general conception it requires experience to mature it, or to identify it in both senses, the very fact that it is a general conception will require that space in one form or another must be given in the contents from which the general conception is formed. Conceptions are general by means of their logical extension. Experience is a protensive quantity. Now the

extension of concepts requires for its completion the influence of posterior experience; but their intension does not. Their intension is constituted by those qualitative elements which express the natural functions of mental experience. When the several elements of individual sense by repetition and the unity of consciousness form a coherent whole, time gives it a consistency which seems to defy analysis, and hence even general conceptions may appear to be original. Then the subsequent discovery that they are not so arouses suspicion as to that of their constituents. But this does not alter the ultimate indication of general conceptions, which is that their origin in experience does not in the least prove the same origin for their constituents, even if they were not on further and cogent inquiry to be experiential. So with the idea of space if it be considered a general conception: or take the general conceptions color and extension. Color is a generalization from individual visual impressions, and as such has no existence covering those cases. It is not likely that all the individual

elements composing it occurred originally at the same moment of time, and since its extension, or presenting several intensive elements, would require time and experience; that is protensive influences to complete the range of its application. Precisely the same language would be applied to the general concept "sensation", or any other generalization. But the intension in every case expresses an original function or product of consciousness, while its extension, whether a repetition of the same identical phenomenon, or a modification of it in disparate experiences, requires protensive influences to give it the synthesis which it possesses as a general conception. Now if the idea of space be taken as a general conception generalized from two or more senses it will of course contain the same suggestive power for the experiences of those senses, and hence tactual space will call up visual space, and vice versa. They will be identified in the general conception. The extension of the idea will not, in that case, be confined to the proper sensibles of individual senses. The intension

elements will express the individual characteristics of the sense from which they are derived and will never be transferred to another except at the conjunction of the two disparate sensations in consciousness. This conjunction is most likely to be, as it is usually at least, the result of experience. Thus the relative identity which intensive elements of visual perception may have with those of tactual perception will require experience for its production; that is protensive experience. That relative identity is the extension of a conception. The extension then which the idea of space may have for sight and touch will not be an original and immediate act of perception independently of a simultaneous conjunction in consciousness, but must involve protensive experience for its completion and perfection as it appears in maturity. But its _intension_ is not subject to such an origin, or to such an analysis as complex conceptions. Now it is with the _intensive_ elements that the doctrine of nativism has to do, while the _extensive_ constitute the field of empiricism. The

intension of the general conceptions "color," or "sensation" is without dispute a native product, whatever may be thought of their extension. So it is with the intension of the idea of space: it expresses a content in conscious impressions for certain individual sources of knowledge, temporally original if regarded as a real and necessary concomitant of sensations and functionally original in consciousness if regarded as ideal and a necessary form of perception. Its extension will require experience to develop it; that is posterior experiences. The former is the field of nativism: the latter the field of **empiricism**. The two are not mutually exclusive except in the same aspects of the problem, or in reference to the same phenomena. Each will have its own distinct province and ought not to be supposed to interfere with the other. Nativism in reference to the idea of space must exist somewhere in its intensive elements.* This

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* Lotze. Grundzüge der Psychologie. p. 29.

" Metaphysik. §§ [illegible]. Logik. [illegible] 437-442.

" Medicinische Psychologie. p. 335. 436.

" Wundt. Phys. Psych. Vol. II. p. 23. Logik. Vol. I. pp 455. 460.

is admitted by both Spencer and Mill; by the latter quite unconsciously of its fatal influence against exclusive empiricism which he was so zealous to establish. Both admit that there is the germinal material in the original sense impressions or the subsequently developed conception of space.* The former, after stating his illustration of the "packed fingers", asks: "What would be the interpretation of any impression thus produced, while as yet no experience had been accumulated? Would there be any idea of extension? Certainly not a developed idea, though there would be the crude material of an idea." He frequently speaks of it as necessarily involved in the consciousness of coexistence. Mill after his scathing polemic against Hamilton, in which he supposes he has refuted him, virtually surrenders the whole question in the following language. "A rudimentary conception must be allowed; for it is evident that even without moving

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* Herbert Spencer. Principles of Psychology. p. 168. Also 167. 201. 204
J.S. Mill. Exam. of Hamilton. Vol. I. p. 295

the eye we are capable of having the sensations of colour at-once, and that the boundary which separates the colours must give some specific sensation of sight, otherwise we should have no discriminative impressions capable of afterwards becoming, by association, representative of the sensations of lines and figures which we owe to the tactual and muscular sense".

These statements of empiricists are exceedingly valuable for their complete reconciliation of the two theories. They admit all that was ever claimed by nativism, or by responsible nativists and imply a very distinct acknowledgement on the part of these authors of the necessity for some fundamental data upon which experience can be built. This is the whole position of nativism, and this theory has always been fortunate and candid enough to admit a very large field for experience: in most cases as large as that claimed by empiricism. But when Mill goes on to identify nativism with the supposition that tactual and visual space are transferable or interperceptible without experience, he completely mistakes the theory in order

to state it. He says: "To have the notion of extension even in length and breadth as we have it, is to have it in such a manner that we might know certain muscular facts without having tried: as for instance, that if we placed our finger on the spot corresponding to one end of a line, or boundary of a surface, we should have to go through a muscular motion before we could place it on the other." If empiricism wishes to mistate the problem for the sake of an easy victory, it is welcome to that kind of controversy; but before it is entitled to either recognition or respect we shall insist that it discuss the issue as defined by those it wishes to refute, or to acknowledge that there is no necessary controversy between the two positions.

Neither Reid, Hamilton, Abbott, Lotze, Stumpf nor Hering have given any such conception of nativism as that which Mill endeavors to refute: indeed they especially deny any such conception of it. Mill introduces into vision the conditions of his own views about muscular sensations in actual space and

and then calls this the view of Reid and Hamilton including nativists generally, when he should make allowance for the fact that they may not be talking about common sensibles at all, but the native powers of individual senses. Besides, as a double answer to Mill, the experimental cases of Cheselden, Wardrop, and Franz seem to show the very conditions which he demands in the innate nature of space to vision. For they show a muscular adaptation of motion to plane dimension immediately. But we do not urge this, as all such experimental cases are exceedingly dubious and complicated. The main point is that nativists are not limited to one such conception of the problem, and as long as they are not it is no refutation of them to prove that experience is required for the adjustment of tactual and muscular to visual perception. The idea of space may be learned and experiential to one sense; but this does not generalize such a conclusion and the experiential nature of common sensibles will not prove the same of proper

sensibles. Each sense, as Reid affirms, may have its own spacial quale, or one may have a spacial quale; so that the question of nativism may be one of the intuition of the idea in one or more senses, and it may be under no obligations to pronounce judgment upon its origin. It is precisely on this point that Bain and Mill both make their mistake. Both believe that the idea of space is derived from muscular and motor sensations; that is, from the movements of our limbs, and that it is thence transferred by association to vision. This is also the view of Berkeley. Now, the nativist may admit readily enough that muscular innervation with its sensations and the consciousness of motion may be the physiological and psychological conditions of the idea of space. He is not obliged to contend that this tactual consciousness of it is native to vision. Nor will its explanation in vision by association prove its empirical

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* J. S. Mill. Exam. of Hamilton. Vol. I pp. 273 – 306

Bain. Senses and Intellect. pp. 181 – 190. 364 – 375

Stumpf. Ursprung der Raumvorstellung. pp. 3[illegible] – 47. [illegible] – [illegible]6

ture in touch. The fact that motion and muscular sensations condition its consciousness in touch also does not prove it empirical in that sense, unless it is shown that the idea of space is some time subsequent to the consciousness of these conditioning phenomena. If it is their necessary, or uniform concomitant it is as original as they and although conditioned by them is still a native product to consciousness. Hence we may admit such an origin of the idea without supposing that it is a proof of empiricism. We may derive the notion from the movements of hands or legs; but this fact of itself is no proof that the origin is an experiential one. Rather the consistency of either theory with such a fact should be a motive to remove the whole discussion of the physiological and psychological conditions of that idea from the province of both nativistic and empirical theories. Science would be a very great gainer by it.

But in admitting that muscular sensations and motion may originate the notion of space, the

nativist neither renounces his right to regard visual space as having a distinct origin of its kind, nor obliges himself to regard space as a native common sensible. He may regard the _intensive_ elements of the notion as peculiar to individual senses, and their _extension_, as a generalized form, in the light of a different phenomenon. This is what he does. Hence without reference to the idea of space as a common sensible we may examine the intensive elements for each of the two senses, sight and touch.

If we assume that the intensive elements of tactual space are _coexistence_ and _non-resistance_, using the first term purely in a tactual sense, we shall see at once why vision does not experience as the immediate and necessary consciousness of them either _really_ or _ideally_ in the form of a tactual image; and we shall see also how necessarily they involve the idea of space with their experience.[1] Weber's experiments show what the coexistence of two tactual states of consciousness imply, and nonresistance

during motor sensations or the consciousness of motion is identical with the perception of space. Both these are original mental states. That they necessarily imply and involve the notion of space is admitted by both Spencer and Bain.* The latter says: "Resistance and empty space are correlates". Now as resistance cannot be derived by experience, and as empty space is its correlate there is no alternative but to regard space as native to touch, because correlates have the same origin. All this is stated in the attempt to prove it empirical. But whether empirical or native the point sought in characterizing coexistence and nonresistance as the intensive elements of tactual space has been to choose two states of consciousness which are not visual sensations and which are not immediately involved in them, and which are yet fundamental elements of the space consciousness; still limiting the term "coex-

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* Herbert Spencer. Principles of Psychology. Vol. II p. 201

Bain. Senses and Intellect. p. 80

istence" to tactual sensations. There is, of course, also temporal and visual "coexistence", but the more general conception is omitted here, to use the concrete form for touch. We shall have occasion to refer to the general conception of it again. The intensive elements of vision we might denominate as convergence, accommodation, muscular and ocular innervation, visual coexistence &c. But that these elements are not necessarily identical with those of touch in the sense that they are interchangeable between the two organs of sight and touch without corresponding experience is an admission of nativism.* Supposing with this assumed difference of intensive elements between the two senses, that the two theories will not be mutually exclusive, or that the proof of empiricism in one is not the disproof of nativism in the other, it remains as the first task before us to consider them within the province of touch. This course will be taken in

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* Lotze. Metaphysik. pp. 564–565

its widest import to include those of temperature, muscular sensation and tactual sense proper, or to denominate in general the extended sensorium of the body.

There are two ways to reconcile discussions upon this question. First, we may show that there is a legitimate field for both theories: that nativism and empiricism are not mutually exclusive; or that each of them expresses a partial view of the whole question. Second, we may show that many of the experiments undertaken to establish one or the other theory are irrelevant either to the proof or the disproof of either one or the other view. In the first case they are positively, in the second negatively reconciled. In the second, the reconciliation is that nothing is proved one way or the other to show them contradictory, or that the problem must be relegated to time, place, and conditions in which it is impossible to prove anything. The relevancy of experiments however in so far as they have been instituted will be a conditional one, or one as shown in the proper way.

The general reconcilation of the two in a positive sense is shown to be possible in the introduction of the different meanings of the term "experience", by the difference of meaning between "experience" and "the result of experience", and by the fact that empiricism must always assume some apriori or native principles as the basis of its operation. That aspect of their reconciliation need not be repeated. But the question whether the idea of space as such is an association of two quantitatively or qualitatively different sensations of that sense may be noticed. Empiricism seems to assert that actual sensations may take place without the notion of space accompanying them, and that it requires practice and experience to become conscious of more than an affection of the sensorium. There are two answers to this. It may be denied, or it may be admitted. When 'actual' sensations are supposed to include any and all of those that may occur in the general sense including the three mentioned, it will not be true that none of them contain

spacial contents. For motor sensations imply a concomitant consciousness of a quality which is as original as the motor sensations themselves. If we regard motor sensations as native, the idea of space must be so; if empirical, it will be empirical also. Motor sensations are not motor sensations except as they imply the concomitant consciousness of space; and the latter will have the same origin as the former. But the discovery of a muscular sense seems to have distinguished very clearly between motor and tactual states of consciousness and we must now recognize that fact. Mill's whole argument for the influence of motor sensations is constructed upon that distinction, and we have come to recognize it as a common one; not as a distinction which too often [illegible]. That purely tactual sensations in the limited sense neither imply a spacial content nor are capable of distinguishing motion and motor sensations. The impression is too common that motor sensations

are to be traced solely to the muscular sense; to muscular innervation and changes consequent thereon. But we may as well be reminded of the significant fact that motor sensations can be as clearly determined by tactual experiences as by muscular. The elimination of the muscular sense as the primary and principal source of motor sensations does not in the least exclude the possibility of motor states in consciousness. The so called passive motor sensations, or those which are experienced without any automatic or voluntary exertion on the part of the patient are illustrations of this. Take as proof the experiments of Prof. G. Stanley Hall and H. H. Donaldson upon the power to perceive motions of tactual impressions.* The same may be shown in the case of Weber's experiments where the consciousness of motion is present upon a less area than is required to distinguish two impressions. By mo-

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* Mind. October 1885.

the sensations are native affections of the tactual sensorium proper, the idea of space must be native, as it is involved in motor consciousness. But eliminating the question of motor sensations, let us take tactual sensations without motion. The question then is, can the space consciousness be a native perception in connection with mere sensations of pressure? Or is it a mere association of qualitatively different tactual states? That it cannot be due to association alone, the passage quoted from Mill sufficiently shows because association must have a content to work with.* It must have the idea of space from some other sense, or one of the sensations under consideration must present it in order that it may be associated with another of a different kind or a different degree. If qualitatively different sensations are associated to produce the idea of space, those of touch and temperature ought never to be located in the same place, and their simultaneous ap-

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* J. S. Mill, Exam. of Hamilton, Vol. I. p. 295.

presence in consciousness should occasion a spatial difference.** So with other sensations. But the mere association of two different sensations will not present more than is given in their contents, unless we assume or admit the position of Kantian idealism which it is the principal object of empiricism to combat. But aside from this association will not *originate* the idea of space.

There remains, then, the first question; namely, whether the idea is a native accompaniment of tactual sensations. This question can be divided into two: whether the idea of space is historically *subsequent* to the occurrence of tactual consciousness, and whether it is historically *concomitant* with it. From the idealistic standpoint it may be subsequent to tactual consciousness and yet be a native function of mind, although repeated experiences in touch may have been required to call the idea in to consciousness.* This is because idealism *may* separate sensa-

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* Bowne. Studies in Metaphysics. p. 447

** Mind. 1887 January. p. 17.

ations and the perception of space so as to ascribe them to distinct functions, both of which may be native as such, but requiring time, or protensive experiences to make them act in conjunction. In fact Helmholtz's "unconscious inferences" if applied to touch would result in the idealistic view as it does in vision, because they would make space a mental addition to the contents of sensation. Hence neither the fact that the idea is a mental addition by means of inferences, nor the fact that it is subsequent to tactual consciousness will prove it empirical. For this idealistic view can make it a native product no matter how late it appears in consciousness, because it still maintains that it is not a modified form of previous tactual experiences. Hence empiricism as against the possibility of that view must prove that it is such a modified product, and not be content with merely proving its subsequent appearance in consciousness. Still it is a position in which the two views are very well reconciled, because both experience and native functions are

required in conjunction to accomplish the result, and it avoids the very difficult if not impossible task of making the conception of space a developed form of tactual resistance. In short it would but regard the notion of space a _native experience_.

Of course, if it be historically _concomitant_ with tactual experiences of every form it must be as original as they, and empiricism admits the native character of sensations. Hence it devolves upon that theory to prove that the idea is a _subsequent_ development of tactual sensations, and not only a subsequent result, _but such as does not make it a necessary result of tactual experience_, and such as would consider it parallel with the more finely developed tactual sensibilities of the blind: _because experience is chosen to explain these variations from the normal functions of consciousness_. Being a variation from normal tactual experience, the idea of space would be a contingent addition to it. This brings us to the experimental aspect of the question.

All experiments that are relative and relevant to the dispute between nativism and empiricism within the sphere of touch excluding the motor sensations belong to that class which refer to localization, and to the distinctions between single and plural impressions. The argument for empiricism and against nativism in these experiments consists of the simple fact that a considerable space may exist between two stimulated points without recognition, although the actual impression is very clear and is capable of considerable variation in intensity without suggesting the consciousness of space. It is assumed then that space is not a necessary element of tactual consciousness. Besides different portions of the [illegible] show different capacities of space distinction, some making finer spacial distinctions than others. This is explained on the supposition that experience and exercise account for this difference and may account for the origin of the space perception itself. For instance, there is a most important difference in the

spacial sensibility of the shoulder blade and the finger tips or the lips, and we know that the experience of those portions of the surface which are the most sensitive has been very different from those portions which are the the least sensitive: hence, after all, this consciousness of space must be due to experience as that influence can account for the variations of sensibility.

There are two replies to this conclusion. The first is from an examination of tactual sensations in experiments; and the second is from the radical distinction between sensations as such and the consciousness of space. In the first place, it must be noticed that all experiments which can be classed under those of Weber represent a class of illusions, and the inference from them is that we must exclude from the native character of the sensations those elements which are not common to all of them. The tactual elements are universal while the muscular are not, and are the source of illusions that in distinct opposition to the conclusions of

drawn from this fact, there is the fact that *localization* is still an accomplished fact and contains all the elements of space construction, whether the mind discriminates or not between the various degrees of fineness in spacial distinctions. The idea of space is already manifest in the localization of the tactual impression at the periphery of the sensorium in both classes of experiments in question; in those of single as well as those of plural impressions. That is, the notion of space is not entirely removed by abstracting it for the illusions recorded — the difference of judgment in connection with tactual stimuli. It remains as complete in all cases for one as for more impressions, because a single impression is referred to some place or relative position in the sensorium as completely as are two impressions each in relation to each other. Hence it is not necessary that we should be able to recognize two distinct states of tactual consciousness at the same time in order

to localize an impression. Localization which assumes space is independent of plural impressions. It must be proved that tactual impressions can exist in consciousness for a time without localization of any kind at the surface of the sensorium, and the class of experiments under consideration decides absolutely nothing in this respect. They prove only various definite spacial discriminations at points previously localized: so that the idea of space is complete, even if in no part of our experience we are able to spacially discriminate between simultaneous impressions. However, it is not meant here to deny the supposition that all localization of impressions, single or plural, is due to experience, but only that all experiments endeavoring to decide the question by showing the limitations of spacial discrimination at the surface of the sensorium do not go to the foundation of the problem, but find the notion of space already matured in the ability of distinguishing between different spacial areas indicated in the distinction between single and plural impressions. If it is

implied that a difference of discriminative powers in sensibility, and not limitation by experience is a presumption on the entire non-localization of all tactual states whatever, by inferring that such experiments indicate the general nature of the sensorium to experience tactual impressions without the necessary consciousness of space, this presumption will not be denied; but only that the case is proved. So far it would seem to favor empiricism exclusively. But it must be as distinctly remembered that the sensorium shows two natural tendencies according to these very experiments. The _first_ is to distinguish clearly between qualitatively different sensations and the _second_ is to impose a limit upon the perception of single impressions. It as uniformly and as naturally perceives double as single sensations. In the first of these, the qualitative differences of sensation perceived are as distinct states of consciousness as ever can be assumed between two simultaneous states

occasioned by separate but similar stimuli upon nerves of the same kind. Hence if we are to suppose that the qualitative differences between two sensations of touch are the the ground of their exclusion from each other in spacial relations, the same exclusion would exhibit itself in the qualitatively different sensations of touch and temperature, or touch and taste, which are simultaneously distinguished as clearly as two tactual sensations. But singularly enough these may be assigned to precisely the 'same' point in space or the sensorium, and no spacial discrimination appears between them. Goldscheider's experiments upon the senses of touch and temperature make this very clear and decisive.* If space perception is not natural to tactual impressions, but the association of two impressions in consciousness showing qualitative differences (? [illegible]) it should appear in all qualitative differences; but it does not. And therefore

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* Du Bois-Reymond's Archiv für Anat. und Physiol. 1885. Supplement. See also "Mind" 1887 January, p. 7

which we may assume to be due to experience. There will be found in merely tactual sensations an original tendency that never exhibits itself at all in the difference between the states of consciousness. But a much more complete argument is found in the fact that two impressions of precisely the same quality to consciousness are differently located, which would not be the case if it depended upon difference of quality: and also qualitatively different sensations will be similarly located which should not be the case if the hypothesis be true.

In the second place, as the mere distinctions between qualitatively different states does not secure spacial discrimination there is no alternative but to suppose it somehow natural to the sensorium, and leave the development of its discriminating degrees of sensibility to experience, the modification of native functions so as to increase its spacial perceptions in definite quantities. Weber and all similar experiments show a limit to the extension of sensible areas, and they have only to be modified to discover

that plural impressions are possible even within the areas which are supposed to represent only single sensations. In the first place, intermediate areas between the limits or circumference of double impressions are always sensitive. The slightest motion within that area is perceptible, and motion involves plural impressions or the consciousness of space. But as we are eliminating motor sensations, we have to assume our illustrations of tactual impressions in a state of rest. Now, if we describe an area within which all simultaneous impressions are perceived as single and then vary the time very slightly of making the two impressions, we shall very distinctly have two sensations which will gradually merge into a single one. For a moment there are two distinct impressions, and the investigator of whatever school admits that two tactual impressions in consciousness at the same time implies space. Hence here the notion of space is possible in an area less than Weber's and similar experiments are supposed to imply.

The limit. There can be plural sensations in a variable one even within the same areas; but in no case can it extend beyond a certain extreme without invariably producing more than one sensation for different stimuli of the same kind. Long before any variation of that limit can be known to consciousness localization has taken place and the notion of space matured, so that any modifications which experience may introduce for those areas are only evidences of definite spacial determinations, within a general consciousness of it already developed, and so no disproof of nativism. The question is only pushed back in time. Besides the possibility of plural impressions within areas supposed to be capable of only single states indicates that it is not the lack of a spacial consciousness which makes impressions seem single within those areas, but only some other physiological and psychological conditions which prevent the recognition of _definite_ space which is assumed to be implied by the consciousness of plural sensations of the same kind. This will be made clearer in what is to follow.

In all experiments and the speculations founded upon them within the sphere of touch done to determine the origin of the idea of space it has uniformly been assumed that the plurality of impressions was the *experimentum crucis* of the problem, and that as long as there was no distinction of separate impressions the conception of space would not exist. This assumption we propose to deny, and to show by experiment that the conception of tactual space can originate without two or more distinct sensations at the same time, and this also within the areas described by Weber's and Volkmann's experiments as the limit of single impressions. The value of plural impressions for proving the existence of space consciousness lay in the universal admission that coexistence of two impressions of the same kind implied space. It was everywhere granted that wherever two distinct tactual sensations were present in consciousness there the notion of space must be found as the condition of their discrimination.

It is quite true that consciousness cannot distinguish two separate impressions of touch, such as those caused as it is conveyed by the [illegible] compasses, without forming the idea of space as expressing a certain relation between the two points of sensation. But it was too hastily inferred that the consciousness of space could not be determined by single impressions. Because two or more distinct sensations at the same time proved the consciousness of space it was supposed that plural impressions were necessary to that consciousness, and it followed immediately from that supposition that one impression could not effect a similar result. But it is one thing that plural impressions should prove the consciousness of space, and an entirely different thing that they should be regarded as the necessary condition and concomitant of that consciousness. For that assumption there is no warrant in fact or in logic, from the mere admission that coexistent sensations of this kind imply space relations. It is

one thing to say that plural impressions cannot coexist without the conception of space, and an entirely different thing to say that the conception of space cannot exist without plural impressions. The latter does not follow from the former. Every experimenter and most speculators at least have allowed themselves to be deceived by this fallacy: and with some few exceptions they are so still that nearly all experimental explanations of space conception are contaminated by the false assumption we have mentioned and exposed. Let us see, then, what experiments have to say in the matter.

In the first place, if it is true that the consciousness of space is the necessary result of two distinct tactual impressions, or that two distinct tactual states imply a difference of localization, it would be impossible for any two points stimulated at the same time to identify the localities of the stimuli. For on supposition the plurality of impressions implies a duality of spatial positions. But this is contradicted

a fact we may have two qualitatively different sensations localized at the same point of space. It is only by this fact that we ever learn to adjust different portions of the sensorium to each other: for instance place the hand upon an affected point on the body and recognize the identity of the location revealed in the two impressions at the time. The famous experiment of Aristotle for showing an illusion in touch by placing a small round object between the two forefingers when crossed will show the consciousness of different positions in space as perhaps the native tendency of the sensorium when stimulated upon two distinct points. But if the same object be rolled or held between the thumb and forefinger, or placed between the finger and any other portion of the experienced sensorium it will produce two impressions, but there is the consciousness of sameness in space, no matter how far apart the two points in the sensorium are removed.*

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* Mind. 1885. April pp. 237–238. July pp. 382. 397.
Helmholtz, Pop. Scien. Lects. p. [illegible].

These facts, however, are of little significance except to indicate that the amount of space recognised by consciousness is not necessarily uniform with the two impressions supposed to determine it. The mere fact of two or more simultaneous impressions does not decide the relative amount of space indicated. This is especially to be noted in comparing the sensibilities of the shoulder blade and those of the finger tips. The capacity to distinguish plural impressions does not guarantee how much space is indicated by them. Hence, instead of two or more sensations conditioning the consciousness of space, it may be that the consciousness of space conditions duality of impressions. At any rate, the consciousness of plural impressions may be a greater approximation to definite space by assigning points of comparison. It may be called the Threshold of definite space whose relative measurement and quantities are the product of experience. But indefinite space may be shown to be antecedent to the consciousness of plural impressions.

of single impressions evince the consciousness of space distinctions, or if consciousness recognizes differences between single impressions which are described in terms of space conceptions it will be seen at once that the assumptions, that plural impressions are necessary to the conception of space, and that single impressions are essentially non-spatial, will fall to the ground. And with these assumptions will go the doctrine of experience said to rest upon the differences of sensitivity for similar impressions made upon disparate localities in the sensorium. Experience may no doubt increase or modify original powers of discrimination; but this is different from determining the space constructions of consciousness.

The first fact to show that a conception of space may be invoked by single impressions is that of vastness or *voluminousness* which distinguishes one single impression from another. It is not a sensation of intensity: for it is quite distinct from this and may attend all degrees of intensity without modification.

But it is a sort of quantitative quale which accompanies single impressions without otherwise modifying their distinctive qualities. It is quite distinct from mere degrees of pressure and varies in the areas which limit the sphere of single impressions. It is also characteristic of more senses than touch. But limiting ourselves to the last, it appears there as a difference between two successive, or two simultaneous, but such impressions, which can be conceived in no other terms than those of space. It is a difference of vastness or voluminousness which is original and can be represented only by spatial conceptions.*

But a more definite fact is before us: an original set of experiments which are confirmed by those of Goldscheider. They were first performed upon myself, and then upon others after blindfolding them and concealing from them entirely the object of them, but leaving the subject to describe his sensations

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* Prof. W. James. Mind. January. pp. 1-8

without any hints from the operator. In every case the same results were reached. First the sensorium was slightly stimulated with the point of a pin; then with two points until the patient could distinguish plural impressions. In two ways this area described by the plural impressions was experimented upon. In the first way the point of the tactual impression was slightly varied in successive trials and the patient would decide very frequently that there was a change of position in space, and long before the circumference of single impressions was reach. But in the second form and with more important results, the impression made by one stimulus was compared with that made by two stimuli within the area of single impressions, and the subject, while conscious of only one impression, would distinguish a difference of "vastness" between them. This difference would increase with the distance between the points of stimulus, although the impressions would still seem single. The points of a compass were used in the same way

with the same result. Invariably with the increase of the points or area stimulated, although the impression was still recognized as one, the effect was described in spacial conceptions. The experiment was then modified. Instead of plural stimuli at points within the area of single impressions, single stimuli with various degrees of dullness were employed. First the end of a pen-holder, which was about 1/8 or 1/10 of an inch in diameter, was tried and then the point of the pen. The difference was very marked and described at once as "vaster": then the point of a lead pencil was compared with the impression of the pen-holder and the difference was marked immediately. Again we started with the point of a sharp pin, and the impression from this was compared with one from a pin whose point was slightly blunted, and then this was immediately compared with that from the head of the pin. In each case a difference of "vastness" was clearly and immediately observed. In all cases the pressure

was made very light, and as nearly equal as possible. The impression made by a pin head was also compared with that of two pin points at a greater distance apart than the diameter of the single pin head, and the result was as expected. The same experiment was tried with objects of greater areas than the points and heads of pins, and like results obtained. But the most significant of all were the differences of "vastness" noticed in the slight differences between a sharp and a blunted pin point, and between the blunted pin point and the head of the pin. The differences were as much marked, and perhaps more marked, than those between single and plural impressions. Certainly a spacial conception was very distinctly perceived, and all this not only within the area of single impressions, but also within the smallest conceivable portion of that. And what is still more important also is the fact that no definite quantities of difference could be assigned. The notion of "vastness" was entirely indefinite: as much so as the con-

roominess of space in the cognition of plural impressions. There is absolutely no constant to measure it by and hence it must remain indefinite. But the main point established by such experiments is the fact that "roominess" (Raumhaftigkeit)*, or spacial conceptions are as possible with single as with plural impressions.

This result however, is not a merely casual result from the experiments we have performed. But it is confirmed by the studies of Goldscheider on both the senses of temperature and of touch.** Most of Prof. James illustrations and experiments indicate the same view.*** But the experiments of Goldscheider are the most conclusive of all because he shows in the cases of temperature and touch alike that the slightest single impressions are accom-

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* Hering. Hermann's Handbuch d. Physiol. Vol. III 1. p. 575

** Goldscheider. Du Bois-Reymond's Archiv fur Anat. und Physiol. 1885. Supplement pp. 10. 75. 77. 82 88. 85

*** Mind. 1887. January. pp. 1 – 30

panied by the consciousness of "irradiation" over an area larger than the point of contact. The impression is not that of an unextended point, but is spacial, and is more extensive as the temperature or tactual stimulus is extended. But in the case of a mere point this "irradiation" is noticed, and it is effective as a matrix out of which definite conceptions of space may be produced.

The significance of such a fact is very great, because it removes the original conception of space from the contingencies of localization which is evidently a relation acquired in many of its aspects however native the tendency to localize sensations may be. Besides, as long as different degrees of sensibility and discrimination in reference to plural impressions upon the sensorium are noticed, and the assumption maintained that the idea of space would not originate until there was the consciousness of two or more simultaneous tactual sensations, the problem seemed left to the question of local

ization. By supposition single impressions were excluded from the production of the idea, and the natural probabilities, afterward confirmed by experimental demonstrations, were that single impressions were the first in the order of time and nature; and if they were the first conditions of sensorial affection, while they were presumed incapable of exciting the consciousness of space, it was evident that the subsequent and empirical development of plural impressions threw the whole problem of space into the field of experience or empiricism. But the notion of voluminousness, 'vastness' and 'extension' affords a content for spatial conceptions independently of plural impressions: yet what is more significant, independently of any definite localization at all. Although all experiments to determine the limits and areas of single sensations found an idea of space involved in the consciousness of an extended sensation clearly manifest, they suggested the possibility that when the

localization was due to experience, after showing the extent to which that influence had determined certain definite spacial discriminations. But the consciousness of a spacial content in single impressions requires no special localization in the sensorium at all. It is simply the difference of volume, or quantitative amount than the intensity in a single sensation without reference to locality in a sensorium. No relativity of position is required, and Goldscheiders experiments make this complete and conclusive. By subtraction also single impressions are with adjustment to plural impressions, and are relations as original events to consciousness. If the notion of space can be indicated by them it can be traced to an origin independently of the experiential data of plural impressions. It is most likely then in such cases it is an original function of consciousness, even if we are to assume the position taken in experimental inquiry. But this does not make its developed form apriori: it only assigns a content to consciousness, indefinite and undeveloped,

upon which experience works to make definite. This is a fundamental position of nativism, and it is not that the fully developed definite conception of space springs at once into existence, like Minerva fully armed from the head of Jupiter. But it is that there is an original *quale* in tactual consciousness which is capable of being developed by experience into that construct which we know in maturity as definite space.* This reconciles the two positions so far as experiments which have been performed can carry the question. If speculation must be carried farther back in human consciousness it will have to be done under circumstances in which experiment by the confession of Helmholtz is impossible.

But the reconciliation can be carried still farther when we recognize that space perceptions are of a kind *sui generis*, and seem *qualitatively* distinct from merely tactual sensations as conscious states, con-

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* Abbott. Sight and Touch. p. [illegible]

ever they may be formally and historically united with Time. The probability that space perception is due to some peculiar physiological or psychological function distinct from sensorial consciousness in general, or at least the possibility of it, makes it quite reasonable from the complex nature of space that it might be historically later in conscious experience than tactual consciousness, whether single or serial. Its conjunction with these states might be due to experience; that is, might not be evoked until consciousness had a history, but its existence in that case would still be the result of an original function, and not a modification of states that contained none of it. This is the position of some forms of idealism, and the value of it is not only that it reconciles in a most complete way the two theories of nativism and empiricism by assigning them both necessary functions in the problem; but also that it may assume experiments to have proved the existence of tactual consciousness originally,

in the mind without even the most elementary consciousness of a spacial quale. Thus the conception of space would be native whenever it appeared, just as recollection and reasoning are native although they are comparatively late in the history of consciousness. The method usually employed to show that the idea of space is empirical would show that sensation itself is the result of experience. Sensation has a threshold as well as the perception of space, and if we are to determine the empirical nature of space perception by the discovery of non spacial conditions or accompaniments historically antecedent to it, the same process may prove the experiential nature of sensation by showing the conditions and activities existing below and historically antecedent to its threshold. But no body has any difficulty in admitting the native character of sensation, any more than the native character of memory and reasoning although experience is assigned a very large part in giving maturity and perfection to all of their

mixed data. Nativism and empiricism here exist together and in harmony, and there is no reason to regard them as contradictory or mutually exclusive in the case of tactual space.

The second method of reconciling the two theories within the sphere of touch is to show that many experiments under certain conditions are wholly irrelevant to the question one way or the other, and only relegate the settlement of the problem to a time and place where any hypothesis whatever can neither be proved nor disproved, and hence absolutely useless for any purposes of knowledge. We have discussed experiments upon the tactual sensorium upon the supposition that they had some criterial power for deciding the question, and so they will have, if the problem is to be confined to what can be determined in adult and mature consciousness. But if empiricists persist in supposing that localization at different points of the tactual sensorium with the notion of space involved is the result of experience, just as discriminative sensibility between single and

visual impression is attributed to experience, and that retinal sensations are originally non-spatial; or also that voluminousness and irradiation suggestions of space conceptions in single impressions are due to experience, it is evident that it relegates the whole problem to infancy, a period when direct interrogation of consciousness is impossible, and when experiments are likewise impossible, or absolutely incapable of deciding anything.* The theories can thus be reconciled by making one as legitimate as the other, but only in such a way as to make them both useless for scientific investigation. As an example of an entire misconception of the question and of the usual argument made by empiricists take a crucial incident from Ribot borrowed from Darwin.**

"Darwin, in his interesting study, Biographical Sketch of an Infant, says that the seventh day,

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* Helmholtz. Phys. Optik. p. 536.

** Ribot. German Psychology of To-day p. 16. Translation

when he touched the sole of the child's foot with a piece of paper, 'it drew back the foot quickly, and bent the toes under, as an older child does when tickled'. But we can see in this only a very vague localization, since the movement of reaction can probably be considered, in this case, as a reflex act. Is localization immediate in some less movable part of the body, as the chest? If so, this would prove the nativist theory; but this has never been ascertained."

It is very interesting and amusing to see how an empiricist will try to evade the force of a fact, and to see how he places the problem where even his own theory has absolutely nothing in its support but an obstinate desire to be, or to appear consistent. In the first place, the "vague localization" which he already admits is all that is necessary for nativism; it is localization at all. But granting that even this does not exist, the explanation of the movement of the foot as reflex action serves no better purpose. Suppose it is reflex. [illegible]

fact would not prove the idea of space empirical. If the explanation of the movement by reflex action is a disproof of nativism, and in favor of empiricism, it would also disprove the native character of sensation and favor its empirical origin, as we have already indicated. For reflex action does not even secure sensation or consciousness: its principle is automatic and unconscious impulse, so that if this reflex movement of the foot is no evidence of native localization it is no evidence of consciousness or sensations, and the indication would be that even tactual consciousness is the result of experience, a position which not even the empiricist has the audacity to affirm. But on the other hand, if he admit that the tactual sensation exists in such a case and is original, and that the infant is conscious of moving its limb, he admits a complete matrix for the native conception of space: especially as every condition is by supposition present in consciousness to awaken that conception, namely tactual and motor sensations.

And again nothing is gained for nativism by demonstrating that localization be proved to exist in "less movable parts of the body, as the chest"; for if that localization is to be proved to an observer apart from the consciousness of the infant, it must be by some intelligent motion instigated by the patient; say a movement of the hand to remove the cause of stimulation in the chest. It is quite true that such a movement would prove nativism; but it is also just as true that a failure to execute such a movement is no proof of empiricism. For, in the first place, the infant must be conscious of the locality of the sensation before; that is, chronologically antecedent to the movement to remove stimulation; and in the second place it would be very readily admitted by nativists that such a movement is the result of experience without in the least affecting the possibility of the truth of that theory. The movement of the hand in such a case would imply a complex conception involving the meaning of the sensation its cause, the means of its removal, and the adjust-

ment of means to end, all of which we would require experience for its execution. The philosophic blindness of the empiricist in such cases is that he does not see it is a question of conscious localization of sensations or spacial intuitions, and not a question as to a knowledge of causes, or the means of removing the impression, and hence he might as well demand that the infant prove conscious localization by talking, as to demand a movement of a limb to indicate it. The failure to move the hand in such experiments would no more prove unconsciousness than the failure to talk. Conscious localization may be perfectly clear and well developed long before there is any intelligent muscular adjustments corresponding to it, so that it devolves upon empiricism to prove that such is not the case before it attaches any significance to the failure to make muscular adjustments of the kind mentioned.

If the dispute therefore between nativism and empiricism has to be settled by deciding whether conscious localization of impressions take place origin-

only in non-movable parts of infants' sensoria other than the feet or hands, the settlement of it will be a physical impossibility, and hence it would be sheer nonsense to argue the question one way or the other. If it be reduced to the question of determining localization in infants, all experiments upon adult and mature senses are useless and irrelevant, because they assume the experience of infant life before it can be interrogated, and the relegation of the problem to infancy, where anything whatever can be asserted or supposed with perfect security against either proof or disproof, is a practical admission that the question is not a scientific one, but a mere dodge to evade the confession of defeat. No fact can be more important than this to show the necessity of conducting both experiments and speculations with a view to determining the physiological and psychological conditions of space consciousness independently of the mere question whether it is native or empirical, whether it is a necessary concomitant of actual sensation or not.

But the possibility of nativism remains [illegible] intact, without impairing the developing influence of experience, if we notice that motor muscular and innervation sensations may not only be original, but also may accompany tactual states, so that whatever conclusions we reach in regard to localization by touch exclusively there still remains the possibility that a conception of space may arise in motor sensations without reference to localization at all. The consciousness of motion is all that is required, and motion involves space. But if this is combined with tactual impressions as it is in the instance referred to and as is most usual in original experiences of touch, the conditions are complete for space perceptions. This is admitted and affirmed by Wundt.* Hence in such cases there is, at least most probably, a content in consciousness which represents the spacial _quale_, and it only awaits experience to assume the abstract form, or to [illegible] the [illegible] to the [illegible] conditions of it; just as sensation itself although native requires experience to become clearly differentiated in consciousness, as heat and [illegible].

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* Wundt: Phys. Psych. Bd. II, p. 24.

We have tried to make room for both theories of space within the phenomena of touch, and it remains to be seen whether a similar result can be attained for vision. The same two methods of procedure could be adopted for this sense as for touch, but as the argument would at least in form be largely repeated, we confine discussion to phenomena exclusive of those that might be common to tactual sensations. There are two ways of conceiving space to be an experienced product of vision. We may suppose it derived by association from some other sense where it may be original. This is the method of Helmholtz.* Or we may regard it as developed from experience in the perception of colors. The latter is the only method by which we can ultimately regard the notion of space as empirical. But without denying association between touch and sight, and without denying the influence of experience within the sphere of

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* Helmholtz. Phys. Optik p. 797. 606
" Pop. Scien. Lects. p. 238

vision, we wish to show nativistic elements in it which serve as a matrix for experience, or for definite perceptions from the background of a content originally undefined, or unexpressed in relation to a constant, or to some well understood datum which contains common characteristics with it. The difficulty with original conceptions is that they can never be defined in terms simpler than themselves; and for that reason they always assume an indefinite aspect. The process of abstraction which is assumed in order determine their relation to particular experiences which are their differentiae drives the mind from a descriptive account of them in those differential phenomena to concomitant phenomena as the mark or sign of their presence. It is this fact which makes the mind resort so naturally to tactual, muscular and motor experiences when endeavoring to make intelligible some visual experience which is their concomitant. This is the ground of the theory of association: but it is forgotten that it will work with vision as well as any of them.

The general problems which concern the visual perception of space are two, corresponding to the distinction between plane and solid dimension. The second may be subdivided into several. But they are:

1st The visual perception of plane dimension.

This involves the phenomena of magnitudes as expressed in superficial area.

2nd The phenomena of visual localization.

This involves the phenomena of distance as expressing solid dimension.

(a) The perception of direction.

(b) The perception of distance.

(c) The perception of solidity.

Two of these (b) and (c) may be either binocular or monocular: the difference between the questions of distance and solidity we shall notice in the right place. The conception of localization might be extended to include the first question, or relative position in given magnitudes: but we mean here to give it the more technical reference to the third dimension.

1st The visual perception of plane dimension.

In the examination of this topic we wish to discuss the relation between the perceptions of color and of space in length and breadth. If they are necessarily connected in the same individual act of perception, if color cannot be separated from magnitude empirically considered, as it is claimed magnitude can be separated from tactual consciousness, the nativity of visual space will be involved in the universal admission of empiricism that color is a native sensation. One empiricist at least admits that, if extension is a necessary concomitant of our conception of color, nativism must have the preference.* It may be that the perception of color is a different function from that of space; but the nature of the conditions of vision is such that there is no conceivable possibility of regarding them historically separate and distinct. But even if they could be regarded as distinct in their historical ap-

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* Ribot. German Psychology of To-day p. 127

pearance in consciousness, while regarding them as product of separate functions it would not be a proof of empiricism. For if they are the product of separate functions, it matters not when in the history of consciousness the space idea appeared, it would still be the original product of its proper function. To be empirical in its origin it must be the product of the same function which produces color, or an original sensation, and at the same time subsequent to it and distinct from it historically in consciousness. There is the possibility of a dilemma here. To make the conception of space a product of a distinct function from that of other sensations is to make it original at once. On the other hand, to make it the product of the same function is to make it a modification of color, touch &c. But empiricism has regarded it completely independently of color, &c. by which it is not a modification of it. Hence its mode of conception and expression makes it constantly gravitate toward the view that the notion of space is the product of a distinct

position, so that its tendency to idealism is evident at a glance, unless it suppose real space capable of affecting the organism after the manner of vibrations which excite the special sensations.

But if empiricism regard the idea as a modified sensation and subsequent to the original sensation in consciousness, it will be in a consistent position, although the proof of it may be another thing. Still its failure even to assume such a position is an ad hominem argument against it. Starting then with the admission of Ribot, the problem is to show at least the probability that the conception of plane dimension is contemporaneous, or historically concomitant with the consciousness of color. We shall first suppose them separate functions, and although a difference of time between their appearances in consciousness would not on this supposition affect the question of nativism, we shall grant for the sake of argument that it would do so, and point out the improbability that their activities would ever be historically separated. If an

unextended point of light could be made visible, there would be some plausibility in the claim for subsequent space consciousness. But as a matter of fact no visible point is ever seen that is not extended, however small it may be, and if it is not extended, it is not visible. Besides the natural conditions of vision are such that light is not thrown upon the retina in points, or a single point: the whole horoptical field of vision is affected at once in one form or another, so that as a matter of historical fact coexistent impressions are original to vision, and under these conditions the supposition that there is not a spacial content in consciousness at the time is as improbable and absurd as the supposition would be that color impressions are not. In the original impressions of color all the conditions are present which are calculated to invoke the conception of space, so that we have absolutely no alternative but to consider plane dimension and color as simultaneous, and the one being original the other must be. The argument for their simultaneous appearance in consciousness will be the same, if we

assume that color and extension are the products of the same function, and there will be additional probability for that concomitancy in the fact that they are assumed to be connected with the same function, or modified forms of the same thing. Wundt thinks that the existence of non-sensible areas in the retina prove the distinct nature of color and space perception.* But we leave this absurd and mistaken view of the case to the trenchant and crushing refutation of Le Conte.** Besides in all cases couched for cataract, and of restored sight plane dimension was immediately and invariably perceived coexistent with color. The only doubt and illusion was in reference to distance.***

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* Wundt: Phys. Psych. Vol. II. p. 69.

** Le Conte. Sight, p. 82. Foster. Physiology pp. 537-538

*** Helmholtz. Phys. Optik pp. 587-593

" Stumpf. Ursprung der Raumvorstellung pp 289-294.

" Wundt. Phys. Psych. Vol. II p. 178

" Hamilton. Lectures on Metaphysics. pp. 389-393.

Abbott. Sight and Touch. pp. 140-162.

There was, of course, difference of apparent magnitude, but the quantity of color perceived varied in a direct ratio with this magnitude, and hence so far from indicating the possibility of their separation it confirmed the correlative nature of color and extension.

The relation of plane dimension and color is much more clear from the fact that it is impossible to distinguish between two colors at the same time without a relation of length or breadth or both. It is found absolutely impossible to locate two distinct colors in exactly the same point. They may be thrown into the same general area by means of binocular combination, but there is either a mixture so as to produce a single compound color, or there is rivalry in which different colors, alternating with each other, are seen in different parts of the field of vision, so that to distinguish between them is to locate them at separate points. It is a simple case of visual coexistence, or the perception of two distinct points or areas of color out of each other. And it

is not necessary to consider binocular vision for this effect: it is as clear and decisive for monocular vision, if not more so. The separation of one color from another in either the binocular or monocular field is identical with a spacial distinction, as a line must be assumed to effect it. There is here the invariable difference of localization that occurs in coexistent tactual sensations. Two colors perceived at the same time constitute a coexistence in vision, and the fact that coexistent colors can be seen simultaneously is denied by no one. It is admitted also to be an original fact of vision, and both observation and experiment will confirm this in every instance. Hence there is absolutely no alternative to the conclusion that space or plane dimension is involved in the simultaneous perception of different colors.*

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* Hamilton. Edition of Reid's Works Vol. I p. 145. Vol. II, pp. 885 917-920. Hamilton. Lects on Meta. pp. 385-388.

" Stumpf. Ursprung der Raumvorstellung. pp. 106-127. 142-153

" Herbert Spencer. Principles of Psychology Vol. II p. [illegible]

" Ferrier. Philosophical Remains. pp. 391-392.

But not is it only upon purely logical arguments for proof. The same conclusion is also demonstrated in all scientific experiments in modern optics. Von Kries and all experimenters admit that it is impossible to localize two distinct colors so that each shall be seen at the same time and in the same place. This is proved by the phenomena of rivalry and the disputed question of color mixture; by rivalry of contours, by rivalry of colors, and by binocular mixture of colors, or the phenomenon so called, whether it be true as a fact or not; that is, whether there is, or is not a mixture to form a single color.* All of them merely show that when two colors are present their existence in consciousness realizes them separately; when single, in the same area.

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* Helmholtz. Phys. Optik. pp. 700-7[illegible].

" " Pop. Scien. Lects. pp. 257-262.

" Wundt. Phys. Psych. Vol. II. pp. 157-161.

" Abbott. Sight and Touch. p. 129.

" Hering. Beiträge zur Physiologie pp. 312-314.

The value of this for the whole question is found in the fact that plane dimension, so far as it is space, is of the same nature as any other dimension, so that the possibility at least, not to say the probability, of its presence in the original consciousness of color affords great probability, as admitted by Ribot, that the third dimension would have a representation in visual vision. Besides we can not conceive solidity or solid dimension as merely associated tactual sensations extra to visual plane surface. The two contents are too nearly alike to visual consciousness to suppose that one is native to vision and the other borrowed by association from touch. Hence if plane dimension be native to vision there is at least a strong presumption that the third dimension is also. And again the argument for such a spacial content in visual consciousness is rendered stronger by the fact that it is not complicated with localization in relation to the previous subject, or what the phenomena of

adjustment convergence and accommodation. There is no necessity for a consciousness of the remaining sensorium that is unaffected. All that is required for the conception is the visual content of actual perception whether it be localized or not with reference to any assumed points. It is not even necessary to suppose projection, nor any anatomical arrangements like those of Müller, Panum or Hering, but only the fact of coexistent and different colors. Even if it be a single uniform color the result will be the same, although the proof of it would be more difficult because the perception of difference is most effectual as an evidence. And again the whole question of binocular vision can be excluded entirely, plane dimensions being given as well by one as by two organs of vision. There is absolutely no alternative to our conclusion but to show that color and extension may be independent of each other in visual perception. The impossibility of this is manifest, and the fact of their necessary coincidence-

Give nativistic position in respect to space the same place it has for color.

To empiricism, however, must be assigned a large place in two or three particulars. To it must be due the development of clearness and distinctness in the perception of limits in magnitude of figure shape and form: also the perception of relative phenomena in the sphere of plane dimensions which serve as it were definitely known moments for making it more intelligible to abstract thought. In fact, all the manifold conceptions of it in mature consciousness and relations that define the plastic possibilities of plane geometric space are due to successive perceptions of experience. To the same source must be traced the accuracy acquired in the judgment of magnitude. First experiences may not only be indefinite and relatively undetermined but also inaccurate and in need of modification for adjustment with experience from different senses. Experience only can accomplish this.

2°. The permanence of visual localization.

In the discussion of this aspect of the question a very complicated system of phenomena and conditions must be introduced, and it is because their joint action is so opposed to [illegible], and apparently so necessary to localization that the dispute between the two theories has been so warmly contested. In the question of plane dimension we had not even to consider ocular movements as a factor, however efficient it may be in the development of definite and relative, as well as distinct, moments in geometrical space. But not only does motion come into the problem of localization, but also the several factors already mentioned in considering the relation of binocular vision to the problem; namely, convergence, accommodation, retinal magnitude, aerial and mathematical perspective, muscular innervation, and perhaps others. It is the difficulty of supposing their original harmonious action which is so favorable to the view of empiricism.

But there is one aspect of localization which may not, certainly does not, involve all the factors we have enumerated. It is the perception of direction. Of course direction within the limits of plane dimension must be as original as that dimension itself, as every coexistent point in the visual extended plane is seen at once in relation to every other point. But the question now is whether any other conception of direction can be native: whether there is a native tendency to assign visible points a position vertical to the sensorium as there is to perceive horizontal directions in a plane.

Considerable difficulty is occasioned by the fact that direction is mostly, if not always, a relative conception. So far as it is relative it implies a point of reference and distance between the point and some other position. This being the case, or upon this supposition the perception of any other direction than horizontal involves necessarily a conception of the third dimension. The question of time

dimension vindicates its claim to genuineness through the fact that it is represented actually upon the sensorium, or in the sensitive object of vision: but if the third dimension is not so represented, or if we can discover no necessary conditions of its construction it seems to be a very different question from the first. And as vertical rather than horizontal direction involves distance, the proof of its reality is the proof of a native third dimension. Hence in this respect it is identical with distance and solidity. But as it is possible to consider it in monocular vision, alone while distance and solidity are usually associated with binocular vision, although not exclusively binocular problems, direction may be examined as the simplest step from plane to solid dimension.

In the first place we must remove an irrelevant presupposition. In empirical perceptions of vision we know absolutely nothing about the representation of plane dimension upon the retinal sensorium. It is only at the age of comparative maturity that

we learn either of the image upon the retina, or of the nature of the conditions which exist between the object of vision and the eye, and in the physiological activities of the organ. This is an important fact, because it not only removes such hypotheses as that we are conscious originally of the retina, but also emphasizes the fact that the origin of the idea of space, plane or solid is independent of any knowledge of its conditions, and that inability to discover conditions for the third similar for the other two dimensions has no relation whatever to what is a historical, not a scientific problem. Intrinsically, therefore, there should be no more difficulty in conceiving the possibility that the third dimension should be native than that plane dimension should be so. It is not a question whether the dimensions have each and all of them their representation upon the retina in the form it takes as the object of the picturing imagination; but it is whether the physiological and psychological processes conditioning them afford any proof or probability that the idea is as original as particular

forms of consciousness. To require the third dimension to be represented on the visual sensorium in a mechanical and material way like plane extension is to judge of visual phenomena after the analogy of touch, in order to conceive them as native; which conception of the case is precisely the thing to be objected to, as we cannot insist upon discussing color after the analogy of resistance with which it has no representative similarity. The question is much more one of fact than it is of how it is possible.

If, therefore, it is not necessary to seek the third dimension in the luminous impression upon the retina; if we have to assume that the facts of direction and distance are known from a pure and immediate knowledge of the definite position exists for making it merely relative to that position, and if projection as it may be called, be a distinctive characteristic of retinal sensations as compared with tactual, there will an original matrix for the development of the third dimension. is Thus con-

jections or the sense of polar relations a native function of vision? If so we may account for its development in the adult by experience. The simplest facts in monocular vision can settle this.

In the first place, if the finger be slightly pressed upon one side of the eye ball a circular image of light will be visible with the eye closed and a dark image with the eye open. But two features of its localization cannot be overcome by any amount of experience or consciousness that the impression of such is made at a different point from that at which the image appears. The first of these is that it appears first and always at right angles to the point of impression and the second is that under such abnormal circumstances in spite of the fact that the sensorium is not affected by light, but by touch there is a special constructions of direction and distance, the latter of which is entirely indefinite, and both of which are determined without reference to a corresponding normal point of comparison. It is noticeable also that

the space construction in which visual activity seems employed at the time is not limited to the assignment of a special position to the image; but there is a consciousness of something besides the image and the position occupied by it. Of course empiricism is ready with the reply that this is due to experience; that the accustomed mode of action is expected of the retina, even under unnatural stimuli. This may be very well admitted, but it at once relegates the whole question to the rational sphere mentioned in touch where absolutely no experiments can be relevant to the discussion one way or the other. But if we cannot suppose the consciousness of more than the limitation of position assigned the image, we are obliged to suppose the native character of the projection which we find takes place in relation to the point of the impression. The indefiniteness of the localized distance is due to the want a perception of the point affected to serve as a relative standard of comparison. Nevertheless the least movement of the eye reveals the fact that

the point of localization is negative to an affected sensorium, at least as compared with tactual experience. This projection takes place in spite of all knowledge that the physiological activity is limited to the retina at the point of pressure. This fact conforms exactly to Helmholtz's demand that if a conception or an activity be native, it must be such as cannot be overcome by experience. It takes place the first time it is tried and no subsequent repetitions of the experiment will modify the result, or the judgment regarding its absolute position, although its position relative to the various lines may be or appear altered by the turning and closing of the unaffected eye. Still the total quantum of space before vision in such cases does not change.

Again if a light be concentrated by a lens upon the sclerotic coat which is translucent, just behind the cornea, it will pass through the vitreous humor and throw a shadow of the retinal vessels upon the retina. An image of them will be projected out in the direction from which the light came, one

at their real distance from the rods and cones; but in the direction of a line perpendicular to the surface of the retina at the point where the shadow falls.* The same phenomenon takes place in the experiment for Purkinje's figures. The cases represent a fundamental and invariable law of vision; namely, of projection which is simply a construction of related images, or the assignment of position for them, indefinitely of course with reference to the sensorium, but in such a way as to afford a psychic means or constant for space. Other entoptic phenomena are more interesting.

If we take a card and perforate it with a very fine needle point so as to make the smallest possible opening through the card, and hold it close to the eye while looking through the hole at a bright gas light we shall be able to see at least three classes of figures: the ordinary muscae volitantes, long and thread like objects which rapidly change and pass away and fixed circular

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* Helmholtz, Phys. Optik. p. 157.
Foster, Physiology. p. 513

points upon the retina. In my own case, and I cannot speak for others as the experiment is my own, several can be seen in the *fovea centralis* which can be determined by moving the card back and forward with some degree of rapidity as we do to observe the retinal vessels. They represent a nucleus of bright light surrounded by a dark band: this again by a band of light and sometimes this by another dark ring. There may be some doubt about their position upon the retina, and besides there seem to be two classes of them differently situated along the lines of vision. They seem in a constant change of position both upon the retina and in relation to each other, showing a constantly moving and excited state of the retina.

But the remarkable fact to be noticed is, not only their projection into the field of vision, but also the perception of different distances between them in the third dimension. In winking some of the lubricating fluid for the eyes also has its shadow projected as it moves down

ward over the pupil. Upon close observation it will be seen the order of their projection is reversed that of their order in existence. This is determined by the muscae volitantes and the descending fluid over the pupil do not act to obscure the circular figures, although they do not alter the spacial relation in which they are seen. There is an effort at accommodation which sometimes if not always reverses the order of their position, but without in the least affecting their relative distances from each other. But the important fact is that the perception of the third dimension is very marked and clear. There seems to be a whole volume of indefinite space occupied by these objects in all degrees of projectile distance from each other. Solid is as distinct as plane dimensions, and as distinct as in ordinary vision. There is no reason whatever to suppose educational influences have conferred this power: it represents too natural a function to justify such a supposition.

After images, ocular spectra and reflected images in mirrors illustrate the same invariable principle of retinal action, and, as in the last case, no consciousness whatever can overcome the apparent direction of the reflected objects, although we know perfectly well that the direction of the image is an illusive one. Still the proof of this is not found in the sense of vision. Infants will grasp behind a mirror for an object and feel disappointed in the failure to reach it. The sense of vision can act only upon this law of direction. Those celebrated cases in which those born blind had their sight restored show that the patient was correct in the perception of direction although deceived in the distance.*

That this law of direction is native is still more scientifically and conclusively illustrated by the

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* Abbott. Sight and Touch. pp. 147. 149. 150.

. Wundt. Phys. Psych. Vol. II p. 78.

. McCosh. Defence of Fundamental Truth. pp. 177 – 181.

comparison of binocular and monocular vision. The law of direction for the former is on the median line and at the point of convergence, and of the latter it is in the line of retinal projection, a line vertical to the retinal surface at the point of stimulation and passing through the nodal point of the eye. The experiment already referred to in the discussion of binocular vision illustrates the case. Two objects are stereoscopically combined by crossing the eyes, and three images are seen: the two outer images are seen according to the law of monocular, and the central image according to the law of binocular direction. The interest of projection is most remarkably shown in the fact that there is a difference of distance assigned to the central as compared with the outer images. To this we have alluded; but it is worth alluding to again in order to reinforce the view that there is trinal extension involved in the difference of position assigned the images, as well as plane dimension in relation to the median line. Two

directions are given in this act, relative positions in a plane surface, and relative position in trinal extension independently of that stereoscopic combination which produces the perception of solidity in the images combined. It is here a perception of trinal direction in the comparison of a binocular image and monocular images at the same time. The illusion of three images, and the judgment of different distances and directions are occasioned, not as Helmholtz says, by the contradiction of one experience with another but by the working of two natural and entirely distinct laws in conditions abnormal to the harmonious action of both with reference to the same end. This projection of trinal extension independently of binocular perception and that it is a natural function of vision are rendered very clear in the case of animals whose eyes are placed upon the sides of the head so that combination is impossible.*

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* Le Conte. Sight. p. 263-267.

The phenomena of upright vision illustrate the the same natural law of retinal localization in the direction of a line vertical to the point of incidence. It is interesting to notice how nearly all empiricists in this matter have gone astray from the simplest natural fact of vision, and have found a serious difficulty for nativism in the perception of objects whose image is inverted upon the retina. Their explanation of the phenomenon is a resort to association with touch implying that the natural position would be the inverted one upon the retina.* But the very simple answer to this is that we see generally in the direction in which the light falls upon a retinal point, but more definitely in a line vertical to the rods' and cones' points.** If the

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* Berkeley. Fraser's Selections. pp. [illegible]
Ribot. German Psychology of To-day. pp. 24. 28
Foster. Physiology. p. 535. Helmholtz. Phys. Optik pp. 612
Bain. Senses and Intellect p. 226.

** Le Conte. Sight p. 83.

retina were a plane surface and projection still followed this law we should always see objects in the position of the image upon it; but the arrangement of it in the form of a curve inverts what would otherwise be the disturbing effect of refraction and adapts a natural perception of objects and their position to each other. According to the implied admissions and the positive arguments of empiricists the facts we have referred to will be in favor of nativism. It seems a fact also in favor of preestablished harmony between the external and internal world, and if that be true, the perception of space will be native according to the admission of Helmholtz.

But this sense of direction vertical to plane dimensions is not limited or peculiar to vision alone. It is a general law of all the senses, so that visual perception of it is no exception. On the contrary it is precisely what should be expected of it. It is necessary to it as a sense.*

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* Le Conte. Sight. pp. 64–72. 102. Wundt: Phys. Psych. Vol. II p. 60. Prof. James. Perception of Space. *Mind.* January. 1887.

There is no way to explain such facts but the assumption that the mind naturally constructs trinal extension, or that the native activities of the retinal consciousness qualify it for the determination of vertical as well as horizontal direction. The same conclusion can be shown in a more metaphysical way by an examination of a view expressed by Helmholtz. This author ventured to suppose that a being living in only two dimensions of space would never have any knowledge of the third dimension. If this supposition were stated in another form; namely, that a being knowing only planes would never become solid dimensions, it would be very true; only the antecedent is absurd and impossible. Hence we wish to show that Helmholtz supposition must mean this if it is to escape the perception of trinal extension involved in the perception of vertical direction.

It must be observed that the subject must be in the third in order to perceive plane dimensions. The perception of direction comes in a plane surface in-

this vertical direction from one of the relative points to another, so that this point must be conceived as invisible from the first position, or be seen as a plane vertical to the one in which the two relative points were first perceived. That is, plane dimension in consciousness involves in its very nature the conception of third dimension, because it grows out of the construction of direction. It is but an illustration of the fundamental law of knowledge which is that consciousness implies the duality of subject and object. That duality shows third dimension as external to the perceiving subject which is related then to the object as direction vertical to the plane of vision. Both points which determine relative direction within this plane are alike objective to vision, and to place ourselves at the position of one to view the other would be to conceive vertical direction in experience to the observer. If dimension of any kind were visible under such circumstances it would

be a plane vertical or perpendicular to the one already known in a position objective to both points, and this would be, as we have said, nothing but trinal extension which is implied in the law of retinal projection. But if only plane dimension exist to visual perception, perception from one relative point in it to another would be inconceivable, which it is not.

But again, take the form in which Helmholtz states it: If a being existed only in plane dimension it could not even know this, because by supposition it could not know a point vertical to its own position without knowing trinal extension — the notions of direction and these exist in the third dimension. It could, therefore, never be conscious of extension at all. Plane dimension is always perceived as vertical to the direction of vision, and, hence although there may be no definite consciousness or perception of intermediate distance, trinal extension is implied in the act of consciousness which constitutes visual extension. Thus the being existing only in plane dimension could learn

of space, not by sight, but by motion only. But as this motion could not be in the third dimension because it does not exist in such a space, it must move from one point to another in a plane surface. This, however, is in a vertical line of direction to its position and involves the third dimension. Hence to escape the consciousness of the third dimension it must be incapable of knowing two dimensions, whether it exist in two or three dimensions. The conclusion forced upon us by such facts is that the impossibility of perceiving one dimension involves the impossibility of perceiving another. Flat-land supposition, therefore, is shown to be impossible and absurd. While on the other hand the possibility of existing in a plane and perceiving another point in it involves the third dimension, especially when the visual perception of a position is always construed as a plane perpendicular to the line of vision. In two respects therefore trinal extension is necessarily involved in the conception of any space at all."

It remains to consider whether the more definite perceptions of distance and solidity, expressing more exact localization, have any native elements in vision. While direction implies a third dimension it is usually employed without special reference to the limits in space or position assigned to the object of perception. We could therefore examine it without reference to the complications involved in convergence, accommodation, aerial perspective, retinal magnitude, and ocular movements. But distance and solidity involve these conditions more fully, and perhaps more definite comparisons of effects upon the organism. This is true at least for mature experience.

In the first place, if distance means motion or muscular movement in order to produce contact and tactual sensations, as Mill and Bain represent it,* then we admit that visual extension is not an immediate object of visual perception.

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* Mill, J.S. Exam. of Hamilton. pp. 282. 296

Bain. Senses and Intellect. pp. 366 368. 371. 376. 383.

But nativists are entitled to their conceptions and definitions of it as well as empiricists. It is true that distance does mean muscular activity and movement; but it is begging the question to say that it is only that. It is also true that the association of tactual experience with vision is developed and empirical in the sense that time and practice are required to complete the adjustment of the two experiences. But this is in no contradiction to the supposition that there is a visual *quale* for general extension different from mere color, and from which the inference can be made. The very fact that the inference is not made from the sensations of color is positive proof of this. If distance meant only so much motion in order to touch an object, differences of color, and especially differences of intensity in color, as in sound, odor and tactual sensations, ought to indicate differences of distance. But this is never the case, except where the difference of intensity is in the same object seen at successive mo-

ments. Still even in this case distance is required to explain the difference of intensity although the two factors vary in proportion. Besides in perception there is no absolute standard of intensity for distance. If there were a house across the street should seem farther off than the sun. It is true that intensity and distance vary with each other in very many acts of perception; but they are rather connected than that any particular degree of intensity should be marked by an absolute quantity of distance variable only with a change of intensity. As a matter of fact all imaginable distances are compatible with all degrees of intensity, other things being the same. But changes of convergence, accommodation &c. very much complicate the their relations. The sense of distance will vary with accommodation, and intensity will affect accommodation; but experiment will show that intensity remaining the same and accommodation changing, the sense of distance may vary. This shows that there is no absolute and invariable relation between

intensity and accommodation, especially as the latter may vary with convergence while intensity remains unchanged. There are too many influences conspiring to affect the conception of distance for us to limit it to one alone. Experiment will show this.

Besides this, if binal and trinal extension are to be kept apart in vision and if the first is a basis for inferences to motion in touch, there must also be some quale in visual sensation by which to infer motion in trinal extension. That is, if there is a quale in the socalled plane dimension of vision for inference to motion in that plane, there must also be a quale for an inference to motion vertical to this plane because by the supposition of empiricism visual extension is no evidence of trinal extension. Now it is precisely this quale in vision that we are contending for, and empiricism has to admit this or give up its theory of inference and association. In admitting it also it abandons the necessity of using them for any other purpose than the ad-

justment of sight to touch. The whole mistake of the empiricist is in supposing that visual and tactual space must originally suggest each other before abstraction takes place in order to be native.

In order to determine a native function in sight to perceive distance we shall examine a series of experiments. They are, however, not one sided in their evidential value: they combine in a remarkable way to show the influence of native and experiential factors. Some are more distinct in exhibiting the native functions of vision, and others a predominance of empirical elements. But it must be remarked before discussing them that they prove everything or nothing. By this we mean that they prove the combined influence of native and empirical factors, if they are relevant to the problem at all: if they do not prove anything one way or the other the problem must be relegated to that sphere of existence where like the phenomena of touch, absolutely nothing can ever be determined for or against any supposition or assertion whatever.

There are three natural and prominent factors concerned in normal vision, the modification of any one of which will exert an influence the perception of space: they are focal distinctness, accommodation and the degree of convergence; retinal magnitude has perhaps only an associational value; motion of the eyes has a prominent and important influence. But in all experiments observation will show that the perception of space is not under the control of any one of these factors alone, so that however they may exercise an individual influence, or even when working together in abnormal relations, the modification of space perception is not exactly proportional to amount of their modification, or if proportional, is not equal to it. If one could say that any degree of accommodation or convergence was equal to a given fixed distance one should expect that amount of space construction at every occurrence of that degree, and a corresponding change at every change of that degree. But experiments will show a limit of this influ-

are much less than the amount of this multiplication.

To show that mere intensity of light and impression will not account for it, take two pins one about three inches long and made of polished brass, and the other about two inches long and made of iron. Place them about four feet apart upon a plane surface. Then take a card perforated with a small, but smooth and round instrument about 1/16 or 1/20 of an inch in diameter. Take a position about eight or ten feet from the iron pin, but in a straight line with both. The light of the brass pin is greater and more intense, and if intensity alone determined the relative position occupied by it in the field of vision it should be seen nearer the observer. But closing one eye and holding the card before it to shut-off all the light except what can reach the eye through the puncture in the card, we distinctly determine at a glance and by monocular vision the greater distance of the brass pin notwithstanding the very marked difference between the two in intensity.

The same appearance of distance can be produced by inverting their relative positions, and in both cases the difference is not altered in any appreciable degree by the change of accommodation required for the distinct vision of one or the other.

As an illustration of the influence of accommodation, take a perforated card and view any object through it by holding the card near the eye and accommodating for different distances. The object will seem to move in a line to and from the observer according to accommodation for near and far distances, just as a locomotive approaches and recedes from an observer while its retinal magnitude increases and diminishes. The same can be noticed by viewing a gas light through two perforated cards, one with a larger puncture than the other and to be used by a different eye. The difference of intensity occasioned by the greater amount of light in one eye than the other and the difference of retinal magnitude gives the appearance of remoter position to the

one image than to the other, especially when the eyes are made to converge so as to separate the images a small distance. But if one eye be perfectly free, so that there is a very marked difference both of intensity in the light in the retinal magnitude of the image for that eye, the difference of distance in the two images is so slight, if any that it cannot be referred to accommodation alone. It may be accounted for by association alone, so that the 'natural power of localization may only be apparently modified. Certainly the difference of distance perceived is not equal to the amount of change in accommodation required to simulate that condition. This is evident not only from the direct observation in the case, but also from the fact that the less the difference of accommodation the greater was the apparent difference of distance.

But this conclusion with the influence of other factors can be shown by a different class of experiments much more complex than these. One of

This has been referred to before, but only a portion of its features dwelt upon. The experiment is as follows. Draw two such circles upon any surface and combine them by convergence. We have said that the central of the three circles thus visible seems both smaller and nearer than the outer ones. On the other hand if they are combined by divergence the central circle seems larger and farther removed than the other two. Now the simplest explanation of the difference of distance between the inner and outer circles is the difference of convergence. When converged the eyes are in a condition to perceive the image nearer than the real position of the objects and when diverged, they are in a condition to perceive it farther off. This explanation is very satisfactory to a certain extent, but it must not imply that the position assigned the combined image is equal to the point of convergence; for it can easily be shown that this is not always, at least, the case. If the circles are placed at

a considerable distance apart and combined by convergence with a visual or similar instrument serving as a means to that effect, the central circle is still seen much beyond it and altogether or nearly in the plane of the other two, or in the real plane of the original circles. If localization of combined images depended solely upon convergence the central circle should have appeared at the point of convergence upon the median line. This will be the case if the circles are near each other, as it can be tested by moving the pencil so as to throw the central circle apparently above or below the pencil. But it is not the case with objects at a considerable distance apart. In the experiment however the important fact to be noted is that a state of retinal convergence does not insure an equal localization of all objects in the field of vision, as can be seen both by the different projectile localizations assigned to other objects in general, and to the two outer circles in particular. Although accommodation is

adjusted here to accord with convergence it does not localize the exterior circles in accordance with the law of combination. In no experiment have I been able to detect a difference between their locality in relation to the observer and that of the two circles in normal vision, and I have tried it for that purpose hundreds of times. But this matters not so long as there is a difference of distance observed between the central and outer circles either in convergence or in divergence. Convergence and accommodation usually going together to determine localization ought, if they have entire control over the result to make their distance the same; but they do not: and in cases where greater distances are concerned their effect is hardly appreciable, when it should according to supposition be more appreciable. The fact is that the two eyes are operating under two very different laws, the law of projection for monocular vision, and of convergence in the median plane for binocular vision. Both are native functions as every one must ad-

mitted by every one who studies illusions, and as is shown by the difference of distance in the same cases where there might be reason to expect no difference to occur.

Another peculiar fact to be considered is the difference of size in the central images as compared with the exterior. If Wheatstone's view be taken as universally operative, a difference of apparent magnitude should determine a difference in distance in the same order. But, in the first place, if any change of retinal magnitude takes place it is due to accommodation, but this will not explain the smaller size of the central circle in convergence and the larger size of the central circle in divergence, the first of which should on association appear larger and the second smaller. Vision here seems to construe its own magnitude and association in spite of the difference of apparent distance seems able to accomplish nothing. As a fact retinal magnitude has very little to do with the problem except as it comes in as a con-

tion, as an incidental factor concomitant either with the influence of some unknown element, or with recognized elements when we have [illegible] to measure their action. Wheatstone was, perhaps, not aware of the influence of accommodation.

But in the same general line we take another experiment illustrating convergence and the perception of solidity, which is but a modified form of relative distance. Take two stereoscopic pictures represented as a mere geometrical outline, and combine them by convergence: there is the well known and inevitable result of apparent solidity in the central figure while the two exterior figures remain as plane. This perception of solidity corresponds to the difference in distance between the inner and outer circles in the former experiment. But a noticeable feature occurs in this case not noticed in the first. The apparent depth of the central figure increases as the convergence decreases: that is, as we move from the figures [illegible]. This illustrates the influence for conver-

gence in greater distances, or the expected result that under circumstances where association may not [illegible], this sense of depth or distance should increase with the diminished convergence for greater distances. But it is somewhat the reverse of normal convergence for distant objects where depth is not exaggerated, but even less than it would do if seen at all. In this case, however, as depth is only a construction of the mind because it is left out of account with the visual arrangement for greater distances.

This, however, may not be a satisfactory account of the case. We propose, therefore, for this and all cases of stereoscopic combination a different theory to account for the perception of solidity, and it will be true for real as well as imaginary ones like those of mathematical figures. It will also be the preparatory step for showing a distinctive native element in the perception of visual extension. To do this we pass by the above experiment for the present.

As an experiment we take four circles each containing a smaller circle within it as represented in the figures below, and denominated Figures 1 and 2. respectively.

Fig. 1.

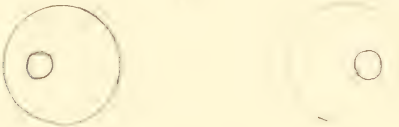
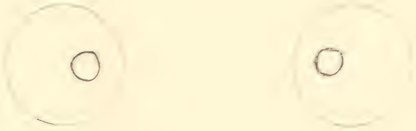


Fig. 2.



If we combine the circles in Fig. 1 by convergence the central figure so formed will appear as a cone resting upon its base with the smaller end or apex near the observer: if they are combined by divergence, on the contrary the central figure will appear as an inverted cone with the base near-

to the observer. But if in Fig. 2. we combine the two circles by convergence the central figure will appear as an inverted cone, the reverse of convergence in Fig. 1. and the same as the result for divergence in that Fig. On the other hand if we combine the circles of Fig. 2 by divergence, the central figure will appear as an upright cone resting upon its base with the apex nearer the observer, again the reverse of Fig. 1. There must be an explanation for this uniformity of opposite results.

In order to present an explanation, we state the general law of convergence and divergence: it is *that convergence and divergence in order to become combinations are directly proportional to the distance between objects to be combined; so the greater the distance between objects, the greater must be the convergence and divergence in order to combine them.*

This can be analyzed into two laws. *First* the greater the convergence the nearer, and *second* the greater the divergence the farther an object will appear.

Or again, the less the convergence the farther, and the less the divergence the nearer an object will appear. And still more exactly is this summarized in the statement that distance varies inversely with the degree of convergence or divergence.

Now to apply these principles to our experiment. In Fig. 1. it requires greater convergence to combine the smaller interior circles than the exterior, because they are relatively farther from the median line, and hence according to the law of convergence the single combined image of the smaller circle should seem nearer which is the actual case, the larger circles appearing at a greater distance because less convergence then need to combine them. On the other hand, in the same Fig. it requires greater divergence to combine the interior than the exterior circles, and according to the law of divergence the combined result will appear more distant, while the larger circles will appear nearer because less divergence is required to combine

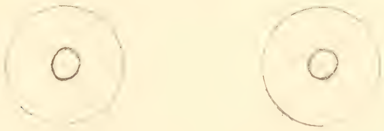
them; they being relatively nearer the median line.

But in Fig. 2 the reverse process takes place as compared with Fig. 1. Less convergence is required to combine the smaller than the larger circles, and hence the combined image will appear more distant according to the law. On the other hand less divergence is required to combine the smaller than the larger circles, and hence the combined result will be the less distance of the smaller combined circle and the greater distance of the larger, according to the law. Actual experiment shows every one of these results to occur exactly as the law requires.

The brief explanation of these phenomena, and the uniformity of the apparent results seen in them is what may be called for the lack of a better name, a double act of convergence. The results correspond exactly to what would be expected of such an act, and the variations of the positions assumed by the lines marking the different distances involved in the conditions of solidity corresponds exactly to

the difference of convergence and divergence involved in such a double act. That this perception of depth is due to such a double act of combination at the same moment of time can be shown both directly and indirectly by experiment. First we take the indirect method, as in the following Fig. 3. Draw two circles as before, and place the smaller internal circles in the centre with the same point for their centres and radii as the larger circles.

Fig. 3.



If these circles are combined either by convergence or divergence there will either be no perception of depth at all, or only such as is alterable at the will of the observer. Even without combination we can conceive them as cones upright or inverted as we please. I have no difficulty in seeing at the same

time one of them upright and the other inverted; nor do I find any difficulty in reversing this relation at pleasure; or seeing them merely as two circles in the same plane which is the natural perception. Now if we turn to Fig's. 1 and 2 we shall find that we can perceive the same facts and inverted relations when they are not combined.

"But combination in Figs. 1 and 2 gives the direct proof of a double act of convergence. In Fig. 3 the circles are all at a relatively equal distance from the median line and hence combination of the smaller circles coincides exactly with that of the larger. No double act of convergence is required to accomplish the combination of both sets of circles at the same time. No struggle between divergence and convergence occurs, and hence the central circles, formed by the combination of the several points at relatively equal distances from the median line, will appear in the same plane. But in Fig's 1 and 2 this is not the case. It is, however, the case in those examples as long as the com-

bination of both sets of circles is not complete. The distance of the smaller circles from the centre can be made so great that in the one case there will be difficulty in combining them at the same time as the larger and in the other in combining the larger at the same time as the smaller. Now until that simultaneous combination comes there is absolutely no perception of solidity, whatever the extension between the two points of convergence. All the circles appear in the same plane. This is also the case when the convergence or divergence is great enough to separate the combined images either of the smaller or the larger, or both into homonymous images by convergence and heteronymous images by divergence. But at the moment of simultaneous combination of smaller and larger circles the perception of depth springs at once into view. There is absolutely no way to explain these results which conform in every case so completely to the simple laws of vision, and to what would be expected

according to our exposition, except by a double set of convergence at the same moment of time.

This view is again confirmed by the results of combinations in the following figures taken from Wundt who notices the perception of depth occasioned by combination, but does not explain it.*

Fig. 4

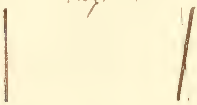
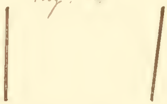


Fig. 5



Combination will produce a perception of depth in both of these figures, Fig. 5 being a similar case of it than Fig. 4, and noticed by Hering.** The latter discusses the combination of disparate lines at same length.*** The following three figures from him confirm again the theory we have advanced.****

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* Wundt. Phys. Psych. Vol. II p. 44.

** Hering. Beiträge zur Physiologie p. 86.

*** " " " " pp. 85–96

**** " " " " p. 129

The two figures are irregularly drawn planes with a set of parallel lines drawn to aid in the proper convergence or divergence.

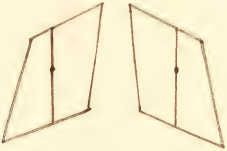

Fig. 6.

In further confirmation of our doctrine we return to the experiment which was interrupted to propose this theory of double convergence. In that experiment we had in view the figures employed by Le Conte.* The sensation of depth seemed to vary with the distance from the figures with which combination was performed, the greater the distance the greater the depth, and vice versa. Now instead of explaining the phenomenon by association it is more probable, and certainly more in accord with our theory when combined with the law of projection in binocular vision, to suppose that

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* Le Conte. Sight. p. 136.

the distance remains in depth almost within its proportion to the whole distance between the observer and the figures combined stereoscopically. It remains relatively the same, but seems absolutely increased in comparison with any special position. This is perhaps due to the influence of the monocular law in combination with the binocular. But however this may be, it is important to observe its relation to the convergence for different distances as such a modification of apparent depth is at first sight at least a peculiarity. We think however that the retinal position for greater or less distances with a tendency to monocular projection in reference to each position and the relative differences of convergence for greater or less distances would afford an adequate explanation of the phenomenon.

The theory here presented has some points of similarity to that of Hering. He explains binocular perception of depth by the rivalry of colour and contour.*

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* Hering, Beiträge zur Physiologie, p. [illegible]

There are adjunct features of it involving the peculiar sense of fillings of smooth length and width over the vision; and various other elements about separate values of depth; but these are extraneous even in this view and unconnected with our doctrine. He was, however, conscious of a fact that was very near the statement of the explanation we have given. But it is not merely a process of rivalry, although this phenomenon may accompany the perception of depth. It is rather as we have shown a process which we have had to express by the terms, indicating a 'double act of convergence", because the results are precisely as if such an act occurred.

But we have alluded to the possible influences of monocular laws on the total result of such phenomena as we have considered. This suggests such a statement of the case as will enable us to see both the relations of binocular to monocular vision, and the perception of distance in monocular vision. Our theory accounts for the perception of

exists in the combinations of [illegible] images, and illustrates the uniform relation between the amount of trinal extension and the amount of convergence or divergence; but it does not explain the perception of distance in monocular vision. This we wish now to connect with binocular vision.

To do this we must determine the common principle operating in both of them, and which is merely modified in the different conditions under which one of them acts as compared with the other. Instead, therefore, of speaking about "double convergence or divergence", we shall speak of a particular and consciously distinguishable process, which we shall call spacial innervation. By this we mean to indicate a retinal or psychical process, just as one may please to denominate it, which operates in the construction of trinal extension, or the third dimension. It is the general law of monocular vision and is connected with retinal distinctions, accommodation and convergence: not that it is con-

only under the control of any one of them, but that [illegible] of localization is modified by them either single or combined. Besides it is a more general case than that of binocular vision, enabling us, as we have already shown, to eliminate that problem from the question, except so far as its explanation can be used as the approach to the real solution. We have shown that binocular vision did not contain the whole problem by the fact that the combination of two plane circles round the homonymous exterior circles localized at a different distance from the observer than the central combined image. If localization must always conform to the degree of convergence there could be no difference of localized distance in the three images spoken of. But the fact that two of the images appear more remote than the combined image and perhaps at the normal distance of monocular vision proves that the problem is more general than the mere perception of solidity,

as the two retinal circles are developed according to the laws of monocular vision. Hence we shall next endeavor to discover the special associations to which we have adhered in the course of monocular vision and then apply it to binocular vision. In order to do this we resort once more to experiments.

Take the geometrical representation of a cube upon a plane surface, as of any solid figure, such as a parallelopiped, a tube, a barrel, or a tunnel; or the common illustration of the stair steps discussed by Helmholtz and Wundt.* Any solid object can thus be made to appear in either of two positions. Either end of a barrel or a tube can be made to seem nearer us. In the case of the stair steps we can alternately perceive the upper or under portion of the stair case as we choose, although in all cases it will require practice to change the ap-

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* Helmholtz. Phys. Optik p. 626
Wundt. Phys. Psych. Vol. II p. 95.

pearance at will. At first some persons find it very difficult to see, but one practice will [illegible] one [illegible]ways. Now the difference between such these and merely plane figures is as distinct to monocular as to binocular vision, and the spacial imagination which we wish to call attention to, for the third dimension which such representations of solid figures make as distinct as if they were real, can be observed with one as well as with two eyes. It must not be forgotten also that the perception of solidity in such cases, distinct as it is, is not due to binocular combination, and is, as we have said, as readily detected in monocular as in binocular perception. Of course empiricism may say that this is all the result of experience; but we have, at present, nothing to do with theories about the *historical* origin of space construction, but with the *physiological or psychological conditions* of that origin, whether native or empirical. Spacial imagination may be coincident with [illegible], a

points with drawings of its origin. Hence if we close one eye, in order to confine the experiment to monocular vision, and view the several representations of solid figures we may alter the apparent position of these objects or figures, or that any point may be made to change its localization in the third dimension: now it seems here and now there; or now it seems nearer and now it seems more remote. These, however, are well known and common place facts. But the important fact to be observed during the process of those changes is a phenomenon which convinces me of an interruption of consciousness, and a very delicate act of innervation which is as distinct to a trained observer as the finest muscular innervation of the eyes.

This change of position or apparent distance would in all cases require actual motion of the solid bodies and the eyes viewing them, and hence there is an association of motion with a kind of expectation of it, but perception disappoints

both association and expectation as the lines do not seem to move in the least. On the contrary they appear perfectly at rest and there is a feeling which can best be described by an act of momentary [illegible]ness, which loses distinctness as we become experienced in making the alternations. This consciousness of innervation involves no illusion of motion, but only a difference of distance and position assumed by the lines. It is rather a psychical or physiological act, or both, recognizing a third dimension in connection with the impressions upon the retina. The same phenomena can be observed in the case of the cross mentioned in connection with the discussion of innervation. The innervation is precisely the same as if the object changed form and position, but absolutely no changes are observed except those of spatial relation: hence we can best account for it by a spatial innervation which characterizes monocular projection. In real cases these alternations would not occur, be-

cause the act of innervation would be controlled by real differences of light and distance which would determine the reflex act of innervation, accommodation, difference of distinctness in retinal images &c, all independently of any influence from the will or the ordinary efforts of thought. But in the geometrical figures representing solidity there is no difference of light and shade, of accommodation, or of distinctness in the images. Besides the converging lines upon the plane surface are precisely the same, and in precisely the same relative position upon the retina which would be characteristic of the corresponding lines in solid figures, and as no disturbing element comes in to control the reflex act of construing the third dimension, the process of vision is at liberty to give it any construction which its natural and instinctive actions will happen upon. It acts according to a uniform law in both cases, and fluctuates from one form of realization to another because there is nothing in the retinal impres-

ion it will assume the direction which spacial innervation would take. At one moment either conception of distance and a concept is at exercise, and once there is an illusion, not because the visual act of spacial innervation is unnatural and erroneous; but because the solidity with which it is associated, and because the total percept of material qualities suggested by it are not present to confirm to other avenues of vision the reality which would consist with the spacial outline in consciousness.

But let us apply our principle to binocular vision and see whether this act of innervation can be discovered at the point where the distinction of distance or the third dimension is made. If we take the figures from Le Conte to which we have referred,* and combine them by convergence with the head turned obliquely to the plane upon which the figures lie we shall discover perhaps, as I [illegible]

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* Le Conte, Sight, p. 86.

in my own case almost at will, alternations of perception. Before combination the figures seem projected toward me, but after it the central figure representing the combined image seems localized in all its lines according to the regular law; that is projected from me. But by crossing the eyes I combine them while the head is turned to one side, there occurs very frequently the same alternation that is noticeable in the alternations of solids we have mentioned. It is, however, only a single alternation that is noticed from the remoter to the nearer position of the smaller end of the object. But it must be noticed, as can be determined by careful observation that the return to the original apparent projection toward the observer is due to the suppression of one of the binocular images in consciousness, as all three images remain with the same relative magnitudes as before. The oblique position of the two eyes increases the tension and rivalry connected with combination and it is easier for consciousness to suppress one image than to endure the strain. Now

just at the moment of this suppression and not when to complete combination there is the distinct innervation spoken of, accompanied with a sort of instantaneous [illegible] accommodating changes of the sudden change from one retinal state for a given combination to that of another, and opposite position in the third dimension. At the moment of suppression the action of perception is left to monocular vision, and the space construction will take the lower form. But at the moment of combination it will take the form which convergence with its accompanying effect upon space innervation will occasion. We have been able after long practice to produce the same effect by momentarily suppressing one of the combined images when holding the eyes in normal position for convergence. But whether suppression takes place or not the important phenomenon to be noticed in the peculiar act or feeling accompanying the retinal change from one impression to another. This is apparently uniform for the perception of relative distances,

and I doubt not that it has been at least vaguely noticed in common experience when correcting an error or illusions in the judgment of distance, as a flying bird that has been located too near or too remote according as the ocular conditions, convergence, accommodation &c. were arranged for near or remote perceptions.

In ordinary experience, however, when consciousness is more under the control of reflex influences from without and the normal activity of vision, such phenomena of innervation will not be so readily discoverable, if at all: because in normal activity it may be said to be an unconscious and automatic activity of the sensorium. But under circumstances where vision is not controlled by the reflex conditions determined from without by the corresponding influences of light, shade, and projection the tension, changes of tension and innervation will become themselves perceptible. Hence we may look for in these peculiar natural activities which have their direction

and effects modified by a change of conditions. When viewing real objects those alternations of perspective do not occur, because visual conditions are under the control of the intensity of light, variations of shade and such influences that prevent alternation. There exists under such circumstances a number of conditions to determine the resultant. But in mathematical figures representing solids upon a plane surface all other conditions are eliminated, and only spatial factors left in isolation from all others to act according to their own special causes. The sudden change of conditions in such cases makes itself felt in consciousness, and as it is uniform with a change of perception in the third dimension we may reasonably suppose a special innervation for distance.

This innervation acts in connection with all the reflex activities of vision and at least to some extent varies with them, but its major variation is with the convergent visual actions of the eyes. But it may retain its constancy for certain per-

tions of the retina when the conditions for different distances are modified and hence spacial innervation modified upon another portion of the retina, as can be seen by the differences of projection between the central and external images in the examples discussed, and also by all degrees of projection in different portions of the retina with monocular vision, notwithstanding the uniformity of accommodation. Indeed relatively this retinal projection and spacial innervation is one of the most fixed constants of vision because notwithstanding any degree of accommodation convergence or retinal distinctness it determines relative differences of localization, although distinct localization is under the control of the conditions to which we have referred, including aerial perspective and apparent magnitude.

Now it is in this fact that we find a point of reconciliation between nativism and empiricism. No doubt experience may do much to develop the motor conjunctions of all accommodations

and conditions which must combine to produce distinct vision and definite localization whether binocular or monocular. It would only be natural to expect so delicate an organism as the eye, with such a complicated set of conditions as are necessary to all definite perception and localization, to require experience for the perfection of its purposes. Hence while definite perceptions of space are in the course of development and adjustment to the experiences of other senses, there is the natural constancy shown in the uniform law of monocular projection and spacial innervation. This is the general sense of relative distances whose definiteness has to be developed by experience on the one hand, and by the conjunction of the natural laws of binocular vision on the other, with perhaps some influence from monocular accommodation. Hence an indefinite sense of relative distances may be the natural product of monocular innervation and definite localization the conjunction of this with binocular vision.

In order to see still farther the relation between physical innervation and definite localization we must compare the processes of perception in monocular and binocular projection combined. We are to keep in mind the very great difference between the localization of images and the construction of that visual content which serves as a field for that localization, and it is thus that the subject receives further analysis.

First then as to localizations.

Binocular vision has two distinct laws. They are:

1st The combination of images for single vision and the most distinct perception.

2nd The localization of images at the point of convergence.

Monocular vision has also two laws. They are:

1st Accommodation for distinct perception.

2nd Localization indefinite for all objects except those of distinct perception which are more definite.

Accommodation consists of two acts: first the contraction or dilation of the iris, and second the contraction or expansion of the lens. They are variable functions in comparison with each other, one not necessarily following the other in equal proportions. One, the first, regulates the amount, the second, the direction of the light on distinct images. Although this variability of the two factors may exercise an influence in the total act of vision, the two generally act so well in unison that we may consider them as one. Now we have indications, and it indicates its limitations on the perception of space, but active control over distinct localizations and distinct perceptions of images. And we have reference only to the simplest and most well known facts.

In binocular vision the points of single vision are in the horopteral surface. It is constituted of points of convergence, one the central and the most distinct, and the others are lateral vertical and distinct vision and localizations. But if at

here we discover the inadequacy of the doctrine of definite localization in solving the problem of space in general. In the first place, the horopteral surface is a variable one while all external conditions remain the same. In the second, while it regulates entirely the positions of single vision and distinct localization with it, it does not determine all localization. And this is why the ultimate solution of the problem cannot be settled by binocular vision, but by the special innervations of monocular perception. Now monocular perception acts in complete harmony with convergence: indeed we may regard the horopteral surface as constituted by the points where the lines of monocular visions intersect. Hence convergence is but a modified form of monocular perception, and the points of intersection, or either the identical or corresponding points of the retina, serve to give distinctness and definiteness to both perception and localization by combination of views, while localization within

and beyond those points is not dependent, except for distinctness, upon the angle or even the fact of convergence at all. For relative distances and localization are still construed on monocular principles within and beyond the horopteral surface, where images are double and less distinct. Hence while definite and distinct localization may be explained by accommodation and convergence, they will not explain the consciousness of an extension not limited by the boundaries assigned by those processes. There is always in binocular and stereoscopic as well as monocular localization of images and perception of relative distances, the consciousness of space between the two points of localized objects, and it is that extension which is not accounted for, and not merely the localization of images. Given the sensual and indefinite contents of retinal sensation accompanying certain forms of spacial innervation, and we may account for definite localization: otherwise we cannot do so, as it is only [illegible] the visi-

ation of visual conditions to make distinct and explicate the contents of a general consciousness which is produced by the reflex activities of the sensorium, and the psychical processes of perception.

However, although the question of space perception is not limited to accurate localization at the point of convergence for binocular, and at the points of accommodation for monocular vision, because there is always a general localization independently of accommodation and attention and which is made more exact by attention without a change of visual conditions, yet, because the differences of localization in the act of binocular vision are due to monocular laws, the perception of the third dimension is ultimately a problem of monocular phenomena. In the spacial innervation to which we have referred we have still to account for the construction of the third dimension in the mathematical representations of solid figures. In these cases the subjective conditions represented in the retinal impressions remain the same for either relation of distance that would [illegible]

vation may choose to give them; that is, the mathematical outlines of solidity upon a plane surface do not represent the same variations of intensity in light & shade, of retinal magnitude and distinctness, but represent all these conditions upon a plane surface which is the constant for their relative localization, and hence eliminating every factor which would involuntarily control localization as the more mathematical lines in [illegible] are the same for either relation of distance which can be construed. The innervation producing that construction is noticeable by virtue of its sudden reversibility: otherwise it would not be. Because it shows the single special projection possessed by some local sign, and the limitation imposed upon its activity by the character of the impression made upon it. Accommodation for various distances does not change this localization or the alternation of perspective. This is because there is an objective element in the impression; namely, the surface upon which the representation is drawn, and which serves as a constant for the

relative assignment of distances by spacial innervation and its reversibility in reference to that constant, while both may be localized at the same time in relation to some other objective point of accommodation. But here it is not reversible, as alternation of perspective is prevented in the perception of real solidity by the presence of other conditions than merely the mathematical representations of it. Here then the innervation cannot be noticed, as escapes ordinary consciousness because there is no reversion of the apparent conditions represented upon the retina. Distinct localization, then, varies with the adaptation of vision and its accommodation to external conditions. But instead of expressing general and indistinct localization in terms of spacial innervation, we may best express its conformity to the law of accommodation which is a variable constant for a more general law, by calling it *an act of nascent accommodation*. Hence we may suppose that the tendency to accommodation, is limited condition of the

sensorium is a moment in the problem, and that it is made more or less an actual state of innervation by the fluctuations of attention while the main direction and a fixed condition of accommodation on a given point remain a constant about which these fluctuations occur. This may be easily applied to binocular vision and its law of convergence. We have in binocular perception both a distinct and an indistinct or general localization as we have seen. The former every one would admit to be due to actual convergence. Now instead of speaking about special innervation to account for the difference between the two means of localization we may refer the indistinct localization, which takes place in both directions from the point of convergence as a constant, to *a nascent act of convergence*. Whenever it becomes actual it will cause distinct perception: hence if double convergence becomes actual at a single moment, there will be separate distinct localizations with the proper perception of their relative distance from each other in the third dimension. But as we have seen

this does not extinguish the consciousness of relative positions and distances intra and extra of the distinct points of localization. The two points of different localization by double convergence serve to define two distinct constants for definite space between them representing solidity. But this is only a resolution of the general into the particular and definite space consciousness. The acts of distinct localization, whether binocular or monocular, and by which empiricism would determine the whole controversy against nativism do not extinguish the consciousness of indefinite spacial localization as they must do if the conception of space in general is to be limited to their special loci. No doubt it may require time and exercise or experience on the part of infant life to perfect the proper adjustment and coordination of all the machinery of distinct localization, including accommodation, convergence, and ocular movements. But in as much as they only determine distinct loci and their relative positions the fact that so-

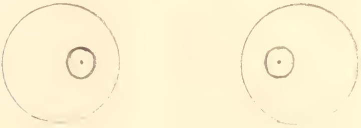
perience may be shown to be necessary for their development and perfection, does not in the least entitle the student to extend an empirical principle to the consciousness of space which is simultaneous with distinct localization, but independent of it by being constant for any changes of movement, accommodation or convergence. Besides the perception of space between two points of convergence without corresponding "signs" of sensation should be as much a problem for empiricism as any indefinite consciousness of it within or without the binocular compass. The usual advantage to the discussion in taking the perception of solidity as crucial in the notion was its clearness. The usual argument that coincident points involved space made it easier to require the presence of such criteria than to assume a single point objectively with reference to the perceiving spirit. As no definite *criteria* could be pointed out in the consciousness of the sensorium, or the surface of the eye to serve as a standard of comparison between it and the localized

point of convergence, or to give two simultaneous and coexistent points of visual extension as there were such points for plane dimension, because we actually had no consciousness of such a point; it seemed that the only possible course was to resort to association, inference and muscular sensations in order to explain the visual perception of the third dimension. If only it could be shown that the two separate loci involved in the perception of solidity were the natural result of visual laws and actions instead of the transferred associations from other senses, the case would be made out in favor of at least a consistent nativism, allowing a field for experience for development into accuracy and perfection. This requisite the theory of double convergence in binocular vision provides very readily, as the experiences of retinal tension, special innervations, or whatever we choose to call them, supply coexistent data for spatial determinations of the third dimension, and coexistence is the universally admitted criterion which is wanted.

In order to get further confirmation for the notions of double convergence, and to show that any number of such convergences may be accomplished simultaneously within certain limits, and in order to indicate more clearly the relation which such phenomena sustain to the general and indefinite consciousness of space, as that vast content of sensations which serves as a field for the definite operations of binocular and monocular lines, we modify some experiments above given, and in such a way as to give a double confirmation of the theory.

Take the original circles of Figures 1 and 2. One set of them, however, will suffice. Hence we repeat them as below.

Fig. 7.



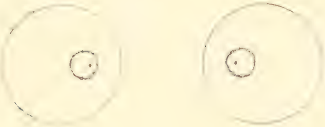
If we place a point in one of the smaller circles

at its centre and combine the figures stereoscopically the result is according to the law, the union representing an inverted cone, but the point seems located in the same plane as the smaller circle, or the circular plane which forms the smaller end of the cone. If they are combined by divergence the localization of the point will still appear in the smaller circle, although the cone will in this case appear upright. The same result would be obtained by placing a point in the centre of each of the two smaller circles, all according to the law of combination, and as would be expected.

But if we place the points, one of them to the right and the other to the left of the centre of the smaller circles, but nearer the median line, so that the two points will sustain the same relative position in the smaller circles in reference to the median line, as the smaller circles sustain in the larger circles in reference to the same line, we shall find their localization completely changed. This is repre-

results in the following figure.

Fig. 8.

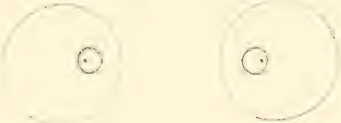


If now we combine the images stereoscopically by convergence we shall find the inverted cone as usual and also the two points combined and developed beyond the plane of the smaller circle, forming a complete apex in the cone. If we combine by divergence the points will form the apex projected toward the observer with the cone resting upon its base. This again is according to the law, and in both cases would be the expected result.

But we can vary the experiment still farther. Place the two points at the opposite sides from the centres in which they are placed in Fig. 8 so that they will be relatively farther from the median line than the smaller circles, and rela-

tinctly nearer than the larger circles. This is represented in the following figure.

Fig. 7.



If we now combine by convergence we see the two points also combined, but localised between the locations assigned the other two images forming the larger and the smaller ends of a cone, with the smaller end projected from us. If they are combined by divergence, the points are still localised, as would be expected according to the law, between the larger and smaller circles, although the position of the cone is reversed from that of convergence. The experiment can be still further varied by placing the smaller circles on the opposite sides of the larger circles relatively more remote than they were the median line. Part-

we should only obtain the same general results as before, merely inverting the order of localization from what appears in Figs. 7. 8 and 9. There would be a difference of localization in every case corresponding to the various degrees of convergence or divergence. Thus we find that any number of simultaneous convergences may take place so as to construe the perception of solidity, and that the localization of an image depends upon the amount of convergence or divergence to unite the two images. That localization does not take place until such a double act of convergence occurs; that is such localization as represents solidity, or a third dimension between the two points or more of convergence. Each serves as a standard for the localization of the other, and both together as coexistent data for the construction of the third dimension in distinct perception, although the result is not a definite representation of the general consciousness of extension, as is shown by two facts. First; the consciousness of a third dimension distinctly [illegible]

ceived between the two points of convergence, or the several points of convergence and divergence combined. 2nd second: The consciousness of space within and around the triangular surface bounded by the lines which pass through the points of convergence, although indefinitely defined. The experiments have only to be tried in order to confirm these facts.

However there are two important facts to be noticed. The first is the mode of conceiving the result as it appears in Fig. 9 and the limits of such combination. We may speak of the whole act as comprehending different degrees of convergence or divergence these being only forms of the same act, viewed relatively to some assumed position. This is the most concise way of stating it. But the complexity of the process is best represented by conceiving the convergence required for the combination of the points as greater than that of the smaller circles and less than that of the larger. Hence relatively to the larger circles the act is one of divergence, but relatively to the smaller, it is one of

greater convergence, as the smaller circles may be said to be divergent in comparison with the larger. Now a very singular fact in connection with this combination is that we can allow the attention to pass from one point of the localization in the stereoscopic figures combined to another without disturbing the combination more than momentarily, if at all. This act is precisely the same as that of moving the eye, as we say, from one point in the third dimension to another in the same act of vision. There is of course a limit to this, and it is the limit of easy combinations; and it is a limit much less than the actual consciousness of combination. At certain limits the combination of one or the other projected images is disturbed. But the fact that the mind can take this motion and is disposed to take it in any case whether the combination is disturbed or not, is additional proof that the third dimension and its construction is a real product. And more important still, the fact that there may be distinct consciousness of

difference in localization at apparent distances which require this peculiar ocular movement to bring the outlines of the localized image into the most distinct projections, but which is likely to dismiss the consideration of the definite distance at least momentarily, goes to show the consciousness of space determinations independently of the central point of attention. This being the case, it is easy to see the possibility of a general construct, the result of an automatic sensational or psychical act, which represents indefinite extension to serve as the field for binocular and monocular localization in the form of definite positions. A certain degree of binocular combination we must thus leave all over the rest of the horopteral surface, as is rendered quite probable by the results of the ocular movement mentioned. But just as vision decreases in distinctness as we pass from the fovea centralis, the conception of a third dimension would decrease in distinctness in the same proportion.

In as much as we have said monocular vis-

sion was but a modification of monocular vision, we must farther ask what the real nature of multiple convergence is. As we have already said, the horopteral surface consists merely of the points of monocular intersection in the lines of projection. Localization in the horopter is therefore only a combination of two acts of monocular projection. Now as double convergence means only that certain portions of the retinas will be brought into monocular projections that will intersect at points nearer or farther than others in the third dimension, the horopter becomes not a plane surface, but the hemisphere of a hollow globe, whose greatest potential distance is opposite the fovea centralis of the Cyclopean eye. These different projections of monocular vision are due in the case of combining mathematical figures to throwing the retina into that state of innervation, which corresponds to the action of the eye in perceiving real objects having solidity. The combination requiring a different degree of convergence or divergence than a given one af-

jects the line of projection in the local sign, and its localization must take place accordingly. The two monocular impressions therefore, assume in the visual line or the median plane a position approaching or receding from the observer according as the combination requires more or less convergence, and modification of a local sign without altering a given combination or a neighboring local sign. In real objects having solidity the distance is the same plus the effects of intensity and variations of light and shade, outline &c.

We proceed next to the consideration of the results in relation to the problem of nativism and empiricism. In the first place, we have shown that the localization of the two exterior and homonymous images in the field of vision during an act of combination is independent of binocular lines and represents a third dimension in comparison with the central and combined image, and its localization. Their localization is due solely to monocular lines

concentrated in the reactions of the innervations of combinations so that innervation theories have but a secondary interest in the problem, except as it represents a peculiar combination of monocular principles. In the second place, we have shown that, according to monocular principles, there is a vast content of space consciousness indefinitely represented in sensation, both between the two points of binocular convergence, and within and without the horopter. Definite quantities and limits are assigned to portions of it according to the laws of vision tends to localize images in it, not to determine its construction by that localization. In the third place, we have shown that, even if we relegate definite space, a definite localization to experience, as the complicated functions of vision render such a supposition possible at least, we do not thereby extinguish the necessity of nativism to account for that indefinite consciousness of extension which is the matrix of its empirical determinations. Localization

of objects in space is one thing and the consciousness of space is another. empiricism in the former is no disproof of nativism in the other.

It now remains to indicate briefly some decided native elements in both monocular and binocular vision, whatever may be admitted in them to be increment of experience. This will be an _a posteriori_ argument for nativism. There can be no question about the facts that the _fovea centralis_,[*] accommodation, convergence and the symmetrical movements of the eyes,[**] are innate functions. "An infant a few hours after birth will follow the movements of a light near its eyes." If localization has so many native conditions, much more should we expect the space consciousness to be native, although requiring experience to form any definite conception of it.

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[*] Le Conte. Sight. p. 75 and 262-269

[**] Hering. Binocular Sehen. pp. 18-23

Ribot. German Psychology of To-day. p. 106.

We turn next to discover what confirmation we can for nativism in the experimental cases of persons born blind, and to see how far we can push the reconciliation between the two theories. In the first place, men of both schools have agreed that little weight could be attached to such cases.* There is much truth in this, because in couching for cataract, or removing blindness, one of the chief conditions of distinct vision is destroyed either temporarily or permanently. Under such circumstances we would hardly expect the kind of results desired for normal vision. The condition rendered imperfect or destroyed is the mechanism of adjustment, the crystalline lens. This serves for accommodation and the formation of distinct images.** But there is a case

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* Foster. Physiology. pp. 497-500

** Helmholtz. Phys. Optik. p. 536.

" Stumpf. Ursprung der Raumvorstellung. p. 289

" Lotze. Medicinische Psychologie. p. 419. *Metaphysik*. p. 564

" Wundt. Phys. Psych. Vol II pp. 178-179.

which none of them seems to have noticed, or at least to have remarked the crucial point in it which must completely reconciles with theories. We take it from Dr. Carpenter.* The boy whose eyes were operated upon was about nine years of age. After the operation he "readily recognized the direction of a candle or other bright object, but was unable to apprehend its distance". "When going about the house at which he was staying in Bristol, and with which he had familiarized himself before the operation, he generally shut his eyes, as if puzzled rather than aided by them." "When he returned home his parents remarked that he was for some time obviously puzzled by his sight, shutting his eyes as he went about in his old way; though whenever he went to a new place he was obviously aided by it."

The fact that he shut his eyes to guide him in familiar places by the sense of touch is proof that visual localization was either not definite, or was not adjusted to the sense of touch.

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* Carpenter. Mental Physiology. pp. 180–181

This was quite to be expected in all cases, but especially since the lens was destroyed by the operation. But the fact that, in spite of this, "he was obviously aided by sight" in new places is very strong evidence for some original space construction. Dr. Carpenter records a second case,* in which the patient very readily perceived the form and shape of visible objects, but could not name them although familiar with them by the sense of touch; and she also expressed surprise and a feeling of stupidity at not having recognized them at once with their form. Here there is not only space construction in visual [illegible], but as in Nunneley's case a consciousness of its identity with that of touch. In Nunneley's case this perception of it as a common sensible was immediate and well defined.** So also the case of Dr. Franz.*** Such cases, however

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* Carpenter Mental Physiology. p. [illegible]

** Mind. January 1887. p. 12.

*** Abbott. Sight and Touch. p. 157. Sully. Psychology. p. [illegible]

McCosh Defence of Fundamental Truth pp. 177–[illegible]

could be analyzed at great length, but instead of emphasizing only one theory as against the other they tend to show a proper sphere for both of them, and the phenomena observed in connection with them can be explained in no other way. There are instances of infants also which are just as clear for native elements in visual space.* Some show original symmetrical movements of the visual organs, others both these movements and acts of accommodation and convergence for various distances. In Home's case of couching for cataract, before the operation the patient could distinguish when a light was *not* "touching his eyes", as the sensation was called.** In all cases there is overwhelming evidence for a native content in visual impressions under the same conditions of vision. This content is the original nucleus out of which all subsequent

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* Hering. Binocular Sehen. pp. 18–23.

Stumpf. Ursprung der Raumvorstellung p. [illegible]

Sully. Psychology. p. 693. *Note*

Abbott. Sight and Touch. pp. 163–178

** [illegible] p. [illegible] *Note*

space experiences are developed: plane dimension will be the most distinct and well defined at first because its conditions are so simple, but solid dimension and definite localization will be later in assuming both the clearness which it has to mature vision and its adjustment to tactual and muscular experience. It will be later because the conditions which effect it are so delicate and complicated, and especially in infant life will require time and exercise for the proper conjunction of these activities in order to transform the indefinite and spontaneous consciousness of space into that which is defined by the loci of accommodation, convergence and movement conditions. But notwithstanding the need of such experience, the original element of the third dimension is given in the sense of direction which has some measure in all experimental sense and in the fundamental character of muscular reflexes, in addition to the clear conditions of plane dimensions. Thus the two theories are supplementary of each other, as ought to be expected from the very notion that sciences must have certain

laws and conditions to work upon. Besides there ought to be no more antagonism between nativism and empiricism in reference to the conception of space than in reference to that of color. Besides there never would have been such a hostility as has appeared between them but for the metaphysical theories supposed or assumed to depend upon the issue between them. But when we have distinguished the question regarding the origin from that concerning the nature of the conception of space, all these motives are removed from the problem at once, and the whole question becomes one whether the notion of space is a natural part of conscious experience, or not. Reduced to this form, we see no way out but to recognize in observation and experiment positive evidence for primitive elements in consciousness whose development in experience terminates in definite conceptions of space. This is only to reconcile the two theories by making the one, with nativism, stand for an original quality which cannot be resolved into modifications of the sense of motion, resistance, or color, and the other for

the formation of that complex conception that is associated with and has so many applications to sense experience which could hardly be attributed to primitive consciousness. This view of the case, we believe, will be more and more the verdict of science.*

But if the objection is raised to all experiments and observations we have referred to that they are the results of adult or mature experience, and therefore inconclusive against empiricism and without proof of nativism we reply, as we have already done, that this relegates the whole problem to infancy, and makes it a historical, not a scientific question. But not very much one way or the other will ever be determined by interrogating the consciousness of infants. They are beyond complete investigation that would make dogmatism reasonable on either side of the case: and yet one who has observed the conduct of infants and their early appreciation of spatial data will have little disposition to deny the claims of nativism, and will as readily accord a legitimate sphere to experience.

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* Cf. Wundt, Logik, pp. [illegible]

But in conclusion of the whole discussion, the distinction just drawn between the historical and the scientific aspects of the problem has very great importance for the proper investigation of the conception of space and its origin. The merely historical order of its appearance in consciousness has little value for us so long as it is not determined whether spatial representation is a peculiar function of its kind, or not, as we have already shown. On the other hand, most students of the question have not been able to distinguish between the conditions of space perception, and its historical origin. This is the peculiar fault of Helmholtz. Wundt has been much superior in this respect. But Helmholtz has invariably assumed that the explanation of illusions, and the discovery of certain conditions for the notion of space were evidences of empiricism. But whatever conditioning influence motor sensations, muscular experiences, tactual or visual, and "unconscious inference", may exercise they may themselves be native, in which case the notion of

space would be native. Nearly the whole of his investigations in vision, in other respects the most admirable ever made for [illegible] senses, is thoroughly vitiated with the assumption that the instances of such mediation as we have mentioned is inconsistent with nativism. There is some apology for this. He had identified that theory with the anatomical speculations of Johannes Müller and Hering, who, he thought and perhaps reasonably, assumed a greater resemblance between the conditions and the product of sense perception than the facts of knowledge would warrant. Successful as his criticisms of these was he supposed that he had refuted the fact of nativism when disproving the conditions, which had been set up as innate principles to account for an original fact. They wish to show how the notion of space would be native, not the fact of it; and in refuting their hypotheses about the conditions, Helmholtz does not necessarily disprove the fact of nativism, as is well shown in speculations about color. The native perception of color is agreed upon in spite of differ-

ence about its conditions. Besides there is nothing in the conditions of space perception as advocated by Helmholtz to forbid the idea that it should be native. But being more or less favorably disposed to the Kantian conception of the nature of space and time, this irreconcilable with some theories of its origin which seemed to him to assume "a preestablished harmony" between the external conditions of sensation and the sensorial product he sought that theory of its origin which would not embody the relative and ideal nature of space. And in doing this he soon finds that a much more radical notion of intellectualism or transcendentalism than Kant: who had confined space perception to the sphere of sense activity. But Helmholtz' theory of unconscious inference is not only not inconsistent with nativism in the more general and Kantian sense, but also tends to relegate the idea entirely to the sphere of the intellect. Were it not for the qualification "unconscious" it would evidently do so. That qualification, however, either makes it absurd or relegates the sources of these

perception to the sphere of automatic sense activity where it becomes a realism of anything at all.

What is needed above all other things in scientific investigation of space perception is to distinguish between the conditions of that process, and the historical question between nativism and empiricism. These are entirely distinct, and the former decides nothing one way or the other until the same question is decided regarding their origin. The idea of space may be conditioned by motor and muscular sensations either tactual or visual, or by [illegible] tactual associations, or by accommodation and convergence &c; but that fact neither proves nor disproves one theory or the other. Science can do an important work in studying the physical and physiological conditions of space perception; but it should not confuse these problems with the irrelevant and entirely independent problem regarding the most historical appearance of the conception of space in consciousness.